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CALIFORNIA INSTRUMENTS
a division of
AIKEN INDUSTRIES, INC.

Revision A
January, 1975

INSTRUCTION MANUAL

MODEL 1501TH

AC POWER SOURCE

SOLID STATE *Invertron*®

FIGURE 1-1

MP MASTER
MA28333

LIST OF ILLUSTRATIONS

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ASSEMBLY REFERENCE DESIGNATOR	DRAWING NUMBER	TITLE
None	C4100-900	OUTLINE DRAWING
None	E4150-400	FINAL ASSEMBLY (3 sheets)
A8	E4100-401	FILTER CAPACITOR ASSEMBLY
A7	C4150-401	DIODE HEATSINK ASSEMBLY
A2	E4100-403	DRIVER HEATSINK ASSEMBLY
A4	E4100-404	DRIVER HEATSINK ASSEMBLY
A3, A5	E4100-405	OUTPUT HEATSINK ASSEMBLY
A2, A3, A4, A5, A7, A8, A9	E4150-070	SCHEMATIC
A1	D4100-700	PRE-AMPLIFIER ASSEMBLY
	D4100-071	SCHEMATIC
A9	D4120-700	SELECTOR CARD ASSEMBLY
	D4120-071	SCHEMATIC
A6	C4050-702	METER BOARD ASSEMBLY
	B4050-072	SCHEMATIC

MANUAL ADDENDUM

MODEL 1501T OPTION H AC POWER SOURCE

INVERTRON

GENERAL

The Model 1501T Option H AC Power Source is similar to a standard Model 1501T AC Power Source except that the unit has been modified to provide:

1) A flat frequency response in the 45 Hz to 500 Hz region.

2) Increased ability to drive pure capacitive loads without instability.

These design trade-offs result in a unit more suitable for operation over the 45 Hz to 500 Hz power frequency range than the standard 1501T. However, the Model 1501T Option H power source should not be used at output frequencies above 2 KHz.

SPECIFICATIONS

The following specifications for a Model 1501T Option H Power Source apply when the unit is driven from a standard T ser-es oscillator and take precedence over those listed in the standard 1501T instruction manual.

POWER OUTPUT:	1500 VA at 91.6% to 100% of rated output voltage with a load power factor of unity to ±0.7.
OUTPUT VOLTAGE RANGES: (Determined by rear loaded printed circuit card)	0 to 30 volts rms. 0 to 60 volts rms. 0 to 120 volts rms. and 0 to 240 volts rms.
TOTAL HARMONIC DISTORTION:	Less than 0.3% distortion from 200 Hz to 6-0 Hz and less than 0.5% distortion from 45 Hz to 1.0 KHz.
AMPLITUDE STABILITY: (after one hour warm-up)	±0.25 per cent for 24 hours at constand line, load and ambient temperature conditions.
LOAD REGULATION:	±0.25 per cent over the range from 45 Hz to 1 KHz when tested at unity power factor. In addition, a load regulation adjustment permits the regulation to be adjusted to zero at any given line voltage, signal frequency and load conditons. Control resolution is 0.02%.

LINE REGULATION:	±0.15 per cent of full output for a ±10 per cent line change.
FULL POWER FREQUENCY RANGE: (1501T-Option H only)	45 Hz to 1 KHz.
FREQUENCY RESPONSE: (when used with 800T variable frequency oscillator)	±1% from 45 to 75 Hz referenced to 60 Hz output. ±1% from 300 to 500 Hz reference to 400 Hz output. Less than 1.0 per cent veriation from 60 Hz to 400 Hz.
CAPACITIVE LOAD:	10 microfarads minimum on 120 volt range.
AC NOISE LEVEL:	80 db below full output while measured with a shorted input: 60 db below full output while measured at full power output.
OVERLOAD AND SHORT CIRCUIT PROTECTION:	Complete protection from overloads and short circuits is provided. Automatic instantaneous reset occurs when overload is removed.
AMPLIFIER DRIVE	5 volts rms (maximum) produces full output voltage. (Determined by selected output voltage range)
AC INPUT LINE:	210 to 250 volts rms. Unit may be wired for the following single phase voltages on special order: 115VAC, 208 VAC, 220 VAC and 240 VAC. Check the serial number tag at the rear of the unit for the exact input voltage requirements.
AC INPUT FREQUENCY	48 to 65 Hz. (400 Hz available on special order).
AC INPUT POWER:	5200 watts maximum under worst case line and full rated load conditions.
OPERATING TEMPERATURE RANGE:	0 to 55°C
FRONT PANEL METER: (Meter range also controlled by	0 to 40, 80, 160, 320 volts AC voltmeter provides ±1% of full scale accuracy at 400 Hz and ±3 per cent of full scale accuracy over the range from 45 Hz to 2 KHz.

DIMENSIONS:	14" high x 19" wide x 21" maximum depth.
NET WEIGHT:	180 pounds.
SHIPPING WEIGHT:	200 pounds.
FRONT PANEL FINISH:	Grey, 26440 per Federal Standard 595 with black silk-screened lettering.

THEORY OF OPERATION

The theory of operation for the Model 1501T-Option H is the same as given in section 3 of the standard 1501T instruction manual except that the preamplifier card has been modified for improved low frequency and capacitive load performance.

A schematic for the preamplifier card is shown in drawing D4100-077. Capacitor A1C1, A1C2, A1C4, A1C5 and resistors A1R9 and A1R102 have been changed to provide improved low frequency response in order to meet the 1% frequency response requirement.

Capacitors A1C3, A1C4, A1C9, A1C12, A1C101 and resistors A1R2, A1R20, and A1R101 have been changed for improved high frequency stability with capacitor load.

CALIBRATION PROCEDURE

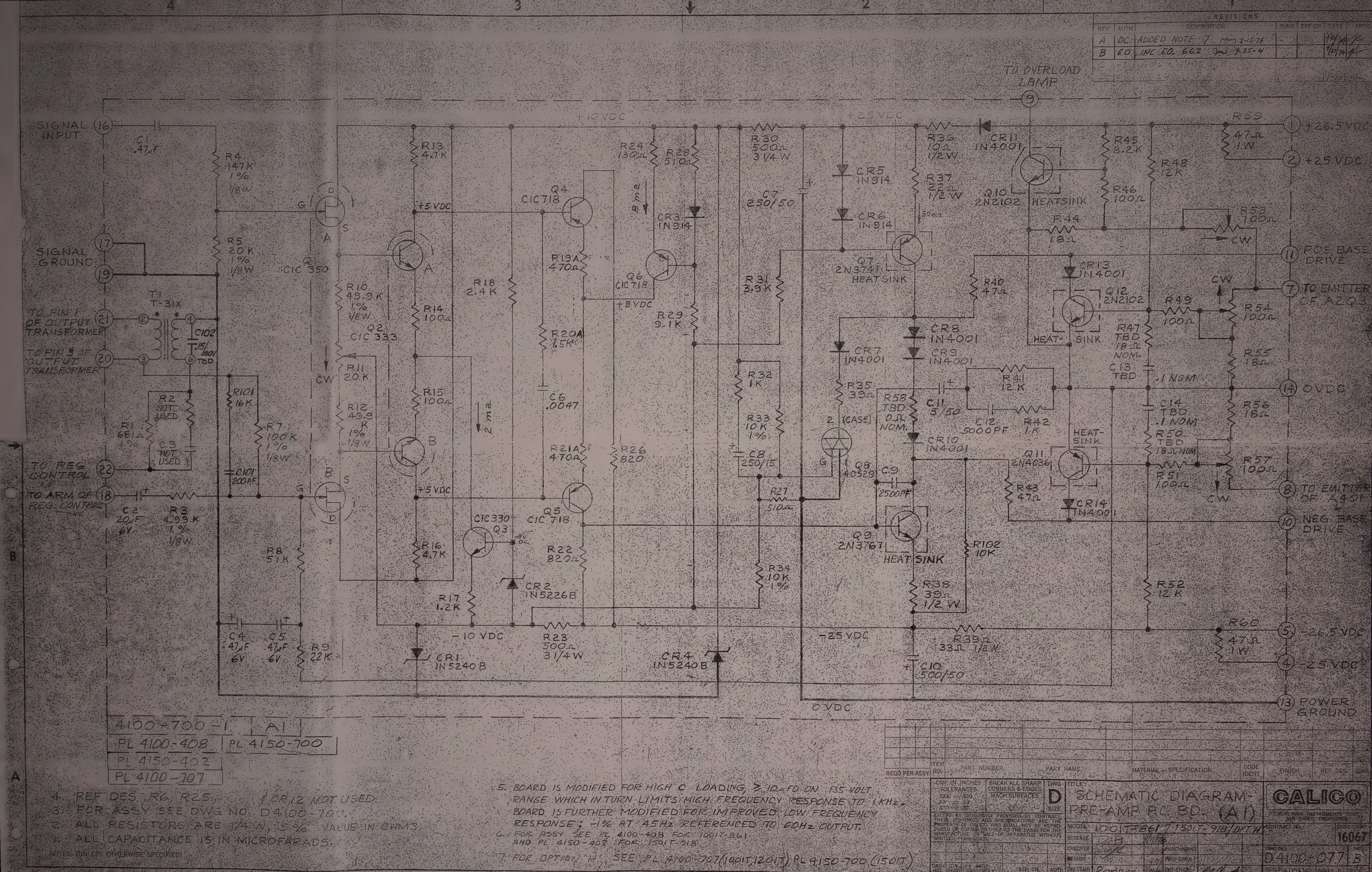
The calibration procedure is the same as given in the standard 1501T except that the unit should be tested to the specifications given in section 2.0 of this manual addendum, rather than those given in the standard 1501T instruction manual.

PARTS LIST

Parts list 4100-707 lists the modifications required to build a Model 1501T Option H AC Power Source from a standard Model 1501T.

ES.	MFG. NUMBER	DESCRIPTION	CODE IDENT.	CALICO STOCK NUMBER	ITEM NO.
	410-707-1	PRE-AMP BD ASSY-OPTION "H" 1001TH/1201TH/	16067		1 2 3
	MODIFY STANDARD 4100-700-1 PRE-AMP BOARD ASSEMBLY AS SHOWN BELOW: (NOTE: DO NOT M/F 4100-700-2 ASSY)				4 5 6
	DELETE FROM STANDARD BOARD ASSEMBLY:				7
	1DP-3-224	CAPACITOR .22 F 100V	72136	6-10566	8
	TE1127	CAPACITOR 5 F 12V	56289	6-10708	9
	ZA1A274K	CAPACITOR .27 F 100V	27556	6-10846	10
	TE1090	CAPACITOR 20 F 6V	56289	6-10444	11
	TE1090	CAPACITOR 20 F 6V	56289	6-10444	12
	WMF1D15	CAPACITOR .0015 F	14655	6-10068	13
	DM15-501J	CAPACITOR 500pF	72136	6-10649	14
	WMF1D1	CAPACITOR .001 F	14655	6-10060	15
					16
	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	17
	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	18
					19
	ADD TO STANDARD BOARD ASSEMBLY:				20
					21
	1DP-4-474	CAPACITOR .47 F 100V	72136	6-10577	22
	TE1090	CAPACITOR 20 F 6V	56289	6-10444	23
	NOT USED				24
	T360B476M006AS	CAPACITOR 47 F 6V	05397	6-10775	25
	T360B476B006AS	CAPACITOR 47 F 6V	05397	6-10775	26
	6DP-1-472	CAPACITOR .0047 F 600V	72136	6-10547	27
	CM06FD252J03	CAPACITOR 2500pF 500V	81349	6-10728	28
	1DP-1-502	CAPACITOR .005 F 100V	72136	6-10079	29
L	CM05FD201J03	CAPACITOR 200pF 500V	81349	6-10282	30
	NOT USED				31
	RC07GF223J	RESISTOR 22K 1/4W 5%	81349	5-10084	32
	RC07GF152J	RESISTOR 1.5K 1/4W 5%	81349	5-10057	33
L	RC07GF163J	RESISTOR 16K 1/4W 5%	81349	5-10081	34
2	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	35
2	1DP-3-154K	CAPACITOR 15 F 100V	72136	6-10478	36

01TH/1201TH/	Calico P/N 4100-707	
PRE-AMP BOARD W/OPTION "H"		ASSY R.D. A1"H"


REVISIONS
REV AUTH DESCRIPTION ZONE EFF ON DATE APPD
A DC ADDED NOTE 7 PER ECO 662 DWS 9-25-74
B EO INC ECO 662 DWS 9-25-74
TO OVERLOAD LAMP
+10 VDC
+25 VDC
SIGNAL INPUT
SIGNAL GROUND
TO PIN 1 OF OUTPUT TRANSFORMER
TO PIN 3 OF OUTPUT TRANSFORMER
TO REG CONTROL
TO ARM OF REG CONTROL
C1 .47µF
R4 147K 1% 1/8W
R5 20K 1% 1/8W
T1 T-31X
C102 .15/100V TBD
R2 NOT USED
R1 681Ω 1%
C3 NOT USED
R101 16K
R7 100K 1% 1/8W
C101 200PF
C2 20µF 6V
R3 4.99K 1% 1/8W
R8 51K
C4 47µF 6V
C5 47µF 6V
R9 22K
Q1 CIC 350
R10 45.9K 1% 1/8W
R11 20K
R12 45.9K 1% 1/8W
R13 4.7K
R14 100Ω
R15 100Ω
R16 4.7K
R17 1.2K
R18 2.4K
Q2 CIC 333
Q3 CIC 330
CR1 IN5240B
CR2 IN5226B
R23 500Ω 3 1/4W
-10 VDC
+5 VDC
2 ma
R19A 470Ω
R20A 1.5K
R21A 470Ω
R22 820Ω
R24 130Ω
R28 510Ω
R29 9.1K
R26 820
Q4 CIC 718
Q5 CIC 718
Q6 CIC 718
8 ma
+8 VDC
CR3 IN914
C6 .0047
R30 500Ω 3 1/4W
C7 250/50
CR5 IN914
CR6 IN914
Q7 2N3741 HEAT SINK
R31 3.9K
R32 1K
R33 10K 1%
C8 250/15
R27 510Ω
Q8 40529
C9 2500PF
Q9 2N3767 HEAT SINK
R34 10K 1%
R38 39Ω 1/2 W
R39 33Ω 1/2 W
C10 500/50
-25 VDC
0 VDC
R36 10Ω 1/2W
R37 2Ω 1/2 W
30ma
CR11 IN4001
Q10 2N2102 HEATSINK
R44 18Ω
R45 8.2K
R46 100Ω
R40 47Ω
CR13 IN4001
Q12 2N2102
HEAT-SINK
CR8 IN4001
CR9 IN4001
CR7 IN4001
R35 39Ω
R58 TBD 0Ω NOM.
C11 5/50
R41 12K
C12 5000PF
R42 1K
CR10 IN4001
Q11 2N4036
R43 47Ω
CR14 IN4001
R102 10K
R52 12K
R53 47Ω 1W
R53 100Ω CW
R49 100Ω
R47 TBD 18Ω NOM.
C13 TBD .1 NOM
R48 12K
R54 100Ω
R55 18Ω
R56 18Ω
R57 100Ω
C14 TBD .1 NOM
R50 TBD 18Ω NOM
R51 100Ω
R60 47Ω 1W
+26.5 VDC
+25 VDC
POS. BASE DRIVE
TO EMITTER OF A2Q3
0 VDC
TO EMITTER OF A4Q1
NEG. BASE DRIVE
-26.5 VDC
-25 VDC
POWER GROUND
4100-700-1 A1
PL 4100-408 PL 4150-700
PL 4150-402
PL 4100-707
4. REF DES R6, R25, & CR12 NOT USED.
3. FOR ASSY SEE DWG NO. D 4100-707.
2. ALL RESISTORS ARE 1/4 W, 5% VALUE IN OHMS.
1. ALL CAPACITANCE IS IN MICROFARADS.
NOTES: (UNLESS OTHERWISE SPECIFIED)
5. BOARD IS MODIFIED FOR HIGH C LOADING, ≥ 10µFD ON 135 VOLT RANGE WHICH IN TURN LIMITS HIGH FREQUENCY RESPONSE TO 1 KHz. BOARD IS FURTHER MODIFIED FOR IMPROVED LOW FREQUENCY RESPONSE; -1% AT 45Hz REFERENCED TO 60Hz OUTPUT.
6. FOR ASSY SEE PL 4100-408 FOR 1001T-861 AND PL 4150-402 FOR 1501T-918
7. FOR OPTION H, SEE PL 4100-707 (1001T, 1201T) PL 4150-700 (1501T)
REQD PER ASSY ITEM NO. PART NUMBER PART NAME MATERIAL - SPECIFICATION CODE IDENT FINISH REF DES ZONE
DIM IN INCHES TOLERANCES .XXX ± .010 .XX ± .03
BREAK ALL SHARP CORNERS & EDGES MACH SURFACES
DWG SIZE D
THE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.
TITLE: SCHEMATIC DIAGRAM- PRE-AMP PC BD. (A1)
MODEL 1001T-861 / 1501T-918 / OPT H
CONTRACT NO.
CODE IDENT 16067
DWG NO. D 4100-077
REV B
RELEASE
CHECKED
DESIGN
PURCHASING
PROJ ENGR
MFG ENGR
SCALE NONE
SHEET 1 OF 1
CALICO
CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

SPECIFICATIONS

MODEL 1501T AC POWER SOURCE

All specifications are tested in accordance with standard California Instruments test procedures and apply with a stable, low distortion input signal as generated by a T series plug-in oscillator.

POWER OUTPUT:	1500 VA at 120 to 110 volts rms output with power factor of unity to ±0.7. See the derating chart on the following page for operation at lower voltages and/or power failure.
OUTPUT VOLTAGE RANGES: (Determined by rear loaded printed circuit card)	0 to 30 volts rms, 0 to 60 volts rms, 0 to 120 volts rms, and 0 to 240 volts rms.
TOTAL HARMONIC DISTORTION:	Less than 0.3% distortion at mid-band (200 Hz to 600 Hz), and less than 0.5% distortion from 45 Hz to 5 KHz.
AMPLITUDE STABILITY: (after one hour warm-up)	± 0.25 per cent for 24 hours at constant line, load and ambient temperature conditions.
LOAD REGULATION: * (on 120 volt range)	± 1% over the range from 45 Hz to 5 KHz when tested at unity power factor. In addition, a load regulation adjustment permits the regulation to be adjusted to zero at any given line voltage, signal frequency and load conditions. Control resolution is 0.02%.
LINE REGULATION:	± 0.25 per cent of full output for a ± 10 per cent line change.
FULL POWER FREQUENCY RANGE: **	45 Hz to 5 KHz.
FREQUENCY RESPONSE:	± 0.5 db from 45 Hz to 5 KHz.

* Load regulation degrades slightly on the 30 volt, 60 volt and 240 volt ranges for operation above 1.0 KHz. See Section 4.7.5 of this instruction manual for test procedure on these ranges.

** This power source may be used over the 20 Hz to 20 KHz frequency range provided the output voltage and the output VA are derated according to Table 2-2 in this instruction manual; otherwise, permanent damage to the unit may occur.

PAGE

4.11 0.7 LAGGING POWER FACTOR 30
4.12 0.7 LEADING POWER FACTOR 31

MAINTENANCE AND TROUBLE SHOOTING

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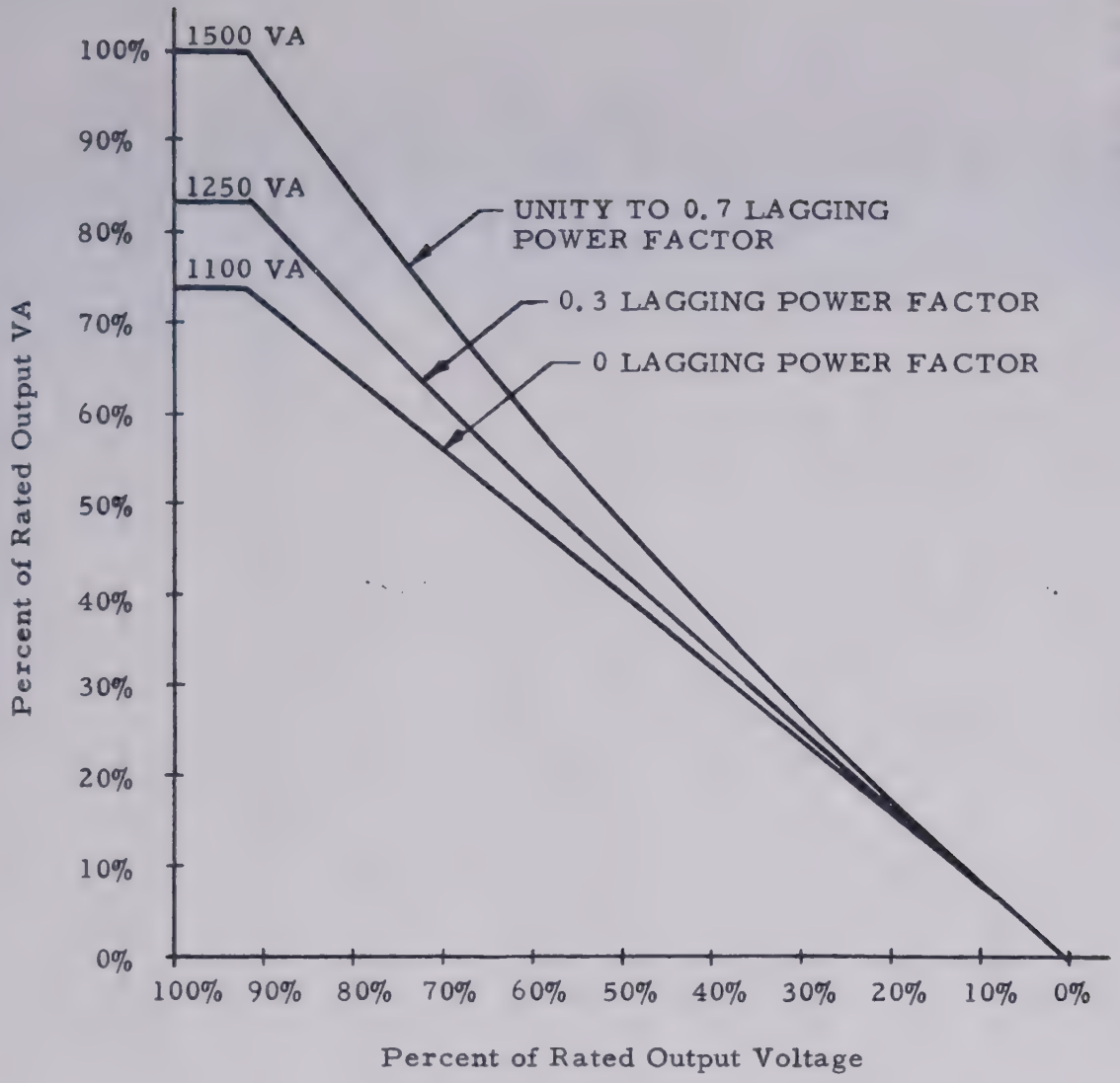
PARTS LIST

APPENDIX A

CODE LIST OF MANUFACTURERS



POWER DERATING CHART FOR MODEL 1501T POWER SOURCE

(Applys over the range from 45 Hz to 5 KHz. Derate the curve for output VA by 2.0 to 1.0 factor at 10 KHz; 3.0 to 1.0 factor at 15 KHz and 4.0 to 1.0 factor at 20 KHz).

GENERAL DESCRIPTION

1.1 INTRODUCTION

This instruction manual contains information on the installation, operation, calibration, and maintenance of the California Instruments Model 1501T Power Source. Detailed schematics, parts location drawings, calibration procedures, and theory of operation are also contained for the aid of maintenance personnel.

1.2 GENERAL DESCRIPTION

The California Instruments Model 1501T Power Amplifier is a solid state, high performance, low distortion power source that provides up to 1500 VA output when used with the proper plug-in oscillator. The Model 1501T Power Source is illustrated in Figure 1-1. Full power output is available in four different voltage ranges and over the frequency range from 45 Hz to 5 KHz. These full power voltage ranges are:

1) 27.5 to 30 volts rms for applications where four units are to be stacked to provide 6000 VA at 120 volts,

2) 55 to 60 volts rms for applications where two units are to be stacked to provide 3000 VA at 120 volts,

3) 110 to 120 volts rms for normal single phase 115 volt applications and for three phase 208 volt line-to-line applications,

4) 220 to 240 volts rms for normal single phase 230 volt applications.

For two phase and three phase operation, at least two power amplifiers must be combined together with the applicable multi-phase oscillator. Two power amplifiers will provide a total of 3000 VA two phase power, or 3000 VA of three phase power in the open delta configuration. Three power amplifiers will provide 4500 VA of three phase power in the wye configuration.

1.3 ACCESSORY EQUIPMENT

The following accessories are available for use with the California Instruments Model 1501T Power Source:

1.3.1 Zero Manufacturing Company Model CTN118 rack slides. These rack slides may be bolted directly to the sides of the unit, if required.

1.3.2 Model 4100-703 Extender Card. This card allows the pre-amplifier printed circuit board to be extended above the unit for service work.

1.3.3 Series 800T Variable Frequency Oscillators. These general purpose Wien Bridge Oscillators provide one phase, two phase or three phase outputs over the range from 20 Hz to 20 KHz in three bands. Units with single phase output are designated as 800T-20/20K-1-1ϕ, two phase oscillators are designated as 800T-20/20K-1-2ϕ, and three phase oscillators are designated as 800T-20/20K-1-3ϕ. Calibration accuracy is ±1 per cent at 25°C and amplitude stability is .25 per cent per 24 hours at 25°C. The total harmonic distortion is less than 0.25 per cent from 20 Hz to 20 KHz.

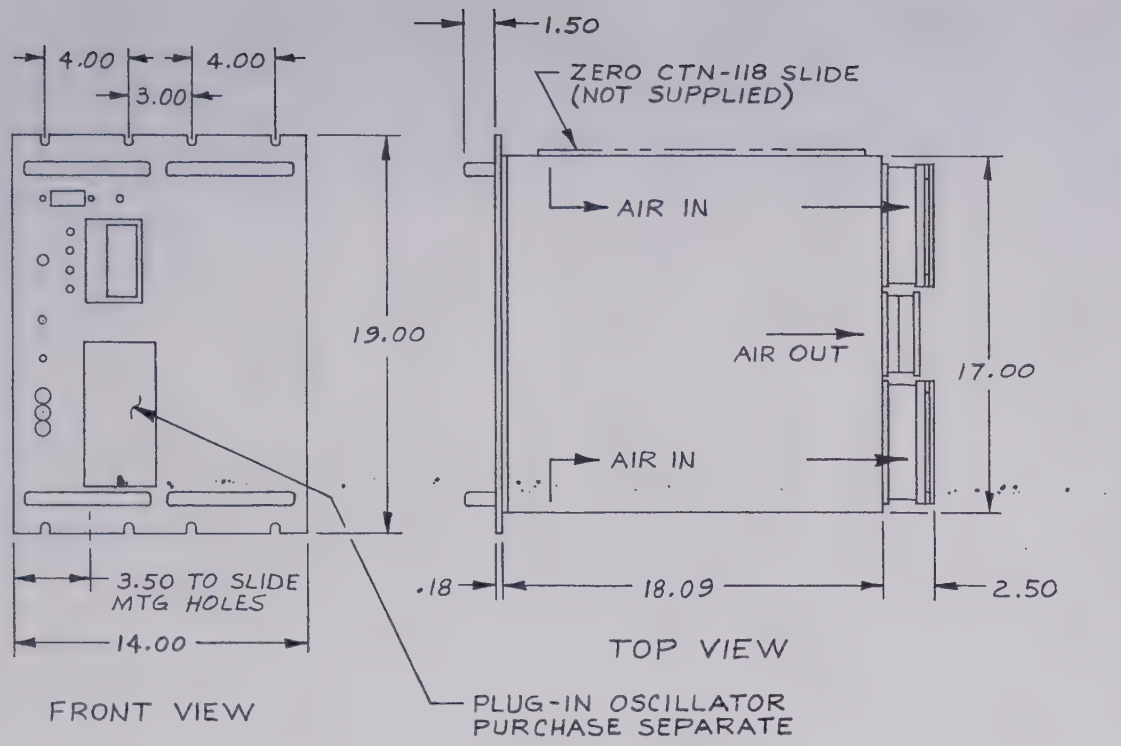
1.3.4 Series 810T Fixed Frequency Oscillators. These oscillators provide one phase, two phase or three phase output over the range from 45 Hz to 10 KHz. Units with single phase output are designated as 810T-Freq-.1-1ϕ, two phase oscillators are designated as 810T-Freq-.1-2ϕ, and three phase oscillators are designated as 810T-Freq-.1-3ϕ. Frequency accuracy is ±0.1 per cent at 25°C. Amplitude stability is ±0.01 per cent per 24 hours at 25°C and varies less than .0025 per cent per degree centigrade. Harmonic distortion is less than 0.1 per cent from 45 Hz to 5 KHz.

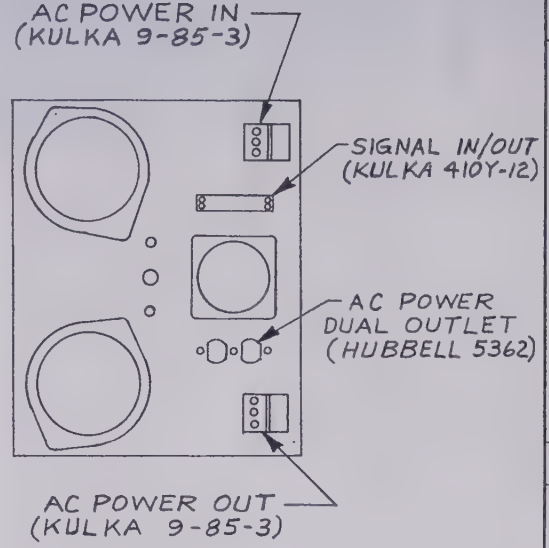
1.3.5 Series 815T Fixed Frequency Oscillators. These low-cost fixed frequency oscillators provide one phase, two phase or three phase outputs over the range from 45 Hz to 10KHz. Units with single phase output are designated as 815T-Freq-.1-1ϕ, two phase oscillators are designated as 815T-Freq-.1-2ϕ, and three phase oscillators are designated as 815T-Freq-.1-3ϕ. Frequency accuracy is ±0.1 per cent at 25°C. Amplitude stability is ±.25 per cent per 24 hours at 25°C and varies less than 0.02 per cent per degree centigrade. Harmonic distortion is less than 0.2 per cent from 45 Hz to 10 KHz.

1.3.6 Series 820T Fixed Frequency Crystal Oscillators. These Oscillators provide one phase, two phase or three phase outputs over the range from 45 Hz to 20 KHz. Units with single phase output are designated as 820T-Freq-Accuracy-1ϕ, two phase oscillators are designated as 820T-Freq-Accuracy-2ϕ, and three phase oscillators are designated as 820T-Freq-Accuracy-3ϕ. Frequency accuracy is ±0.01 per cent or ±0.0001 per cent. Amplitude stability is 0.25 per cent per 24 hours at 25°C. The total harmonic distortion is less than 0.15 per cent for versions from 45 Hz to 5 KHz.

1.3.7 Series 830T Programmable Oscillators. These oscillators provide one phase, two phase or three phase outputs over the range from 45 Hz to 9.99 KHz. These units are packaged in a separate 5-1/4 inch package which may be mounted above/below the associated power amplifier.

1.3.8 Series 840T Programmable Oscillators. These plug-in oscillators provide one phase, two phase or three phase outputs at 380, 400 and 420 Hz. Frequency accuracy is ±0.1 per cent of programmed value. Servo feedback is taken from the output of each phase back to the 840T Programmable plug-in oscillator and provides an accuracy of ±0.1 per cent of programmed value.





C4100-900/

1. FRONT PANEL DIMENSIONS PER W.E./E.I.A STD.

NOTES: (UNLESS OTHERWISE SPECIFIED)

ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
REQD PER ASSY							

DIM IN INCHES TOLERANCES
XXX = .010
XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES ✓

DWG SIZE C

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TITLE: OUTLINE DRAWING
1000 VA, 1200 VA & 1500 VA
POWER SOURCE

MODEL: 1001-T ; 1201-T ; 1501T

RELEASE			
CHECKER	[illegible]	1/16/70	PURCHASING
DESIGN	R. A. Davis	1/5/70	PROJ ENGR
DRFTSMN	[illegible]	1/5/70	CHF ENGR

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CONTRACT NO.

CODE IDENT 16067

DWG NO. C4100-900 REV /

SCALE 1/4 SHEET 1 OF 1

CALICO F-102

CAUTION

HIGH VOLTAGE (250 VAC)

Voltages up to 250 VAC are available in certain sections of this power source. This equipment generates potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions. Do not touch electronic circuits when power is applied. Avoid contact with pin C and pin D of the plug-in oscillator, the primary power circuits, and the output circuits of the power source.

INSTALLATION AND OPERATION

2.1 UNPACKING

The California Instruments Model 1501T Power Source is shipped in a cardboard container with protective inner packing. Do not destroy the packing container until the unit has been inspected for possible damage in shipment.

2.2 POWER REQUIREMENTS

2.2.1 The Model 1501T Power Source has been designed to operate from any one of the following AC line voltages: 115 volts, 208 volts, 220 volts, 230 volts or 240 volts rms. The power transformer is normally wired at the factory for operation from the 230 volt line. Table 2-1 below indicates how the primary connections to the power transformer are made for various AC input line voltages.

TABLE 2-1

NOTE

Prior to reconnecting power transformer T1, remove all existing jumpers from the primary windings.

Nominal Input Voltage	Operating Line Voltage Range	Power Transformer Connections	Front Panel Circuit Breaker Value
115 volts rms	105-125 volts rms	jumper pins 1 and 3; jumper pins 2 and 6; connect load side of circuit breaker to pin 6.	50 ampere
208 volts rms	190-226 volts rms	jumper pins 2 and 3; connect load side of circuit breaker to pin 4.	30 ampere
220 volts rms	201-239 volts rms	jumper pins 2 and 3; connect load side of circuit breaker to pin 5.	30 ampere
230 volts rms	210-250 volts rms	jumper pins 2 and 3; connect load side of circuit breaker to pin 6.	25 ampere
240 volts rms	219-261 volts rms	jumper pins 2 and 3; connect load side of circuit breaker to pin 7.	25 ampere

2.2.2 The Model 1501T has been designed to operate over the line frequency range from 48 to 65 Hz. On special order, units will be supplied to operate from the 400 Hz line.

2.2.3 The normal input power, at rated output, is between 3400 and 5200 watts depending on line and load conditions. During "turn-on" the peak transient will generally exceed 7500 watts.

2.3 CIRCUIT BREAKER REQUIREMENTS

The Model 1501T Power Source uses a 50 ampere Heinmann AM12-50A curve 5 circuit breaker for operation from the 115 volt AC line. A Heinmann AM12-30A curve 5 circuit breaker is used for operation from the 208 volt through 220 volt AC lines. A Heinmann AM12-25A curve 5 circuit breaker is used for operation from the 230 volt through 240 volt AC lines. Substitution of circuit breaker type or current rating may cause permanent damage to the unit.

2.4 OUTPUT VOLTAGE, METER RANGE, AND FRONT PANEL RANGE INDICATOR

2.4.1 The output voltage available from the Model 1501T Power Source is determined by a rear loaded printed circuit card. This card plugs into a connector located inside the power source and accessible by removing the small fan at the rear of the unit. Rotate the printed circuit card until the desired output voltage range has been found and then re-insert the printed circuit card into the connector and replace the fan.

2.4.2 This card is also used to select the proper range for the front panel voltmeter and to illuminate the proper front panel range indicator lamp.

2.5 ACCEPTANCE TEST PROCEDURE

Inspect the unit for any possible shipping damage immediately upon receipt. If damage is evident, notify the carrier. DO NOT return an instrument to the factory without prior approval. If the unit appears in good condition, perform the following.

2.5.1 Connect the AC line input to an AC power line of the proper voltage and frequency as determined by either the serial number tag on the unit or by inspection of the wiring to the primary of the power transformer (see Section 2.2 of this instruction manual). Use number 8 wire to connect the AC power line to the AC input terminals at the rear of the unit if the unit is being operated from the 115 volt AC line; use number 10 wire if the unit is being operated from the 208 volt through 240 volt AC power line. Connect a 5 KW Variac and a 5 KW wattmeter in series with the AC line. Turn the variac up to the required line voltage and then apply AC line power to the power source. The Model 1501T Power Source should draw less than 400 watts under no load conditions at mid-line voltage. If a problem is encountered, perform step 4.3.2 of the CALIBRATION PROCEDURE.

2.5.2 Using either a California Instruments 800T Series Oscillator or a suitable external low distortion sine wave oscillator, set the oscillator to the desired frequency (between 45 Hz and 5 KHz) and adjust the output of the oscillator to 5 volts rms. The amplifier input is available at pin 2 (tie oscillator ground to pin 1) of the small terminal strip TB1 located on the rear of the unit, if the external oscillator is employed. Tie a jumper strap from pin 2 to pin 3 of TB1 if an 800T Series Plug-in Oscillator is being used as the signal source.

2.5.3 Select the proper output voltage range according to the procedure given in Section 2.4 of this instruction manual. The following table lists the proper external load for full power output on each of the voltage ranges.

Output Voltage Range	Output Voltage	Full Power Load Resistance	50 Percent Power Load Resistance
-30 volts rms	30 volts rms	0.60 ohms	1.2 ohms
-60 volts rms	60 volts rms	2.4 ohms	4.8 ohms
-120 volts rms	120 volts rms	9.6 ohms	19.2 ohms
-240 volts rms	240 volts rms	38.4 ohms	76.8 ohms

2.5.4 Connect the proper 1500 watt load resistor to the large output terminals at the rear of the power source which are labeled "AC POWER OUTPUT HIGH-LOW." Connect a Tektronix Model 533A Oscilloscope or equivalent across this load resistor.

2.5.5 Using the GAIN control and the proper range on the front panel METER, set the output voltage to the rated voltage of the unit as determined in Section 2.5.3 of this manual. The power line wattmeter should read 3700 to 4600 watts at mid-line. Check on the oscilloscope for peak clipping or excessive distortion of the sine wave output.

2.5.6 With the output still adjusted as determined in 2.5.5, place a resistor in parallel with the external load resistor to provide a 50% overload on the output of the power source; the value of this resistor is given in Section 2.5.3 of this manual. The signal on the oscilloscope should exhibit significant clipping on both the positive and negative peaks.

2.5.7 Remove the 50 per cent overload resistor and the output should automatically return to normal.

2.5.8 Place a short circuit in parallel with the external load resistor and then remove the short circuit after a few seconds. The signal on the oscilloscope should go to zero and then return to normal when the short circuit is removed. The front panel circuit breaker may be activated if the short circuit remains across the output for a period of time.

2.5.9 The CALIBRATION PROCEDURE given in Section 4.0 of this manual should be followed if a more detailed evaluation of the unit is required at this time.

2.6 MECHANICAL INSTALLATION

The Model 1501T Power Source has been designed for rack mounting in a standard 19 inch rack. The unit should be supported from the bottom with a shelf-track or supported from the sides with a pair of rack slides (Zero Manufacturing type CTN-118 or equivalent.)

The cooling fans on the rear of the unit must be free of any obstructions which would interfere with the flow of air. A 2.5 inch clearance should be maintained between the rear of the fans and the rear door of the mounting cabinet. Also, the air intake holes on the sides and rear of the power source must not be obstructed.

2.7 INPUT POWER WIRING

The Model 1501T Power Source will operate from single phase input voltages from 105 volts to 260 volts rms in five ranges as described in Section 2.2 of this manual. The power source should be used with 115 volt power lines with a capacity of 50 amperes or greater. If 200 to 260 volt AC lines are used, their capacity should be 30 amperes or greater.

2.8 OUTPUT POWER WIRING

The power output wires should be large enough to avoid excessive line voltage drops. The front panel regulation control is capable of providing greater than 2 per cent over regulation for all normal load conditions. If it is desired to provide a zero output impedance at the load side of the power wiring, it is necessary that these line drops be limited to approximately 1 to 2 per cent of the required output voltage. The following table lists the minimum acceptable wire size for a 1.0 per cent line drop assuming a 1500 VA output at a distance of 20 feet from the power source to the load.

Output Voltage	Maximum Line Drop	Load Current	Loop Length	Minimum Required Wire Size
30 volts	0.3 volts	50 amperes	40 feet	#2
60 volts	0.6 volts	25 amperes	40 feet	#8
120 volts	1.2 volts	12.5 amperes	40 feet	#14
240 volts	2.4 volts	6.25 amperes	40 feet	#20

The wire size should be reduced 3 sizes every time that the distance between the power source and load is doubled.

2.9 FRONT PANEL CONTROLS

2.9.1 The circuit breaker, located on the front panel of the Model 1501T Power Source, is used to switch the POWER to the unit "ON." At this time the amber indicator lamp located above this circuit breaker should glow.

2.9.2 The GAIN control is used to adjust the output voltage level of the power source. In the case of a multi-phase power source, the gain control is turned nearly fully clockwise and then used as a fine gain trim control. The amplitude of the output of the multi-phase system is controlled by the amplitude control located on the multi-phase oscillator.

2.9.3 The REG control is recessed behind the front panel and is screw driver adjustable. This control is used to vary the output impedance of the power source. Turning this control in the clockwise direction reduces the output impedance of the power source. If this control is rotated far enough in the clockwise direction, the power source will exhibit a negative output impedance and may be used to compensate for line voltage drops between the output of the power source and the load. Section 2.8 includes additional information on the possible application of this control.

2.9.4 The RANGE lamps on the front panel indicate which output voltage range, 0 to 30 volts, 0 to 60 volts, 0 to 120 volts or 0 to 240 volts is activated by the rear loaded printed circuit card. The corresponding voltmeter ranges are 0 to 40 volts, 0 to 80 volts, 0 to 160 volts and 0 to 320 volts, full scale, respectively.

2.9.5 The OVERLOAD lamp on the front panel indicates if the power source is being loaded excessively. This lamp may be activated momentarily during start-up of a non-linear load such as an AC motor load or an incandescent lamp load.

2.9.6 The front panel circuit breaker will be activated if the power source is loaded with an excessive amount of shunt capacitive load. If shunt capacitors are used to correct the power factor of an inductive load, connect a small amount of resistance in series with the shunt capacitor. The value of this resistor should be equal to approximately 10 per cent of the reactance of the shunt capacitor at the operating frequency of the system.

2.10 OPERATION OVER EXTENDED FREQUENCY RANGE

2.10.1 This power source must not be driven at signal frequencies below 20 Hz or above 20 KHz, otherwise permanent damage to the unit may occur. For operation in the region between 20 Hz and 45 Hz and for operation in the region between 5 KHz and 20 KHz, derate the output voltage and output power according to Table 2-2 in order to provide reliable operation of the power source.

TABLE 2-2

Output Frequency	Maximum Safe Output Voltage				Maximum VA Out at Maximum Safe Output Voltage wi ± 0.7 Power Fact Load.
	30 Volt Range	60 Volt Range	120 Volt Range	240 Volt Range	
20 Hz	13.3V	26.6V	53.2V	107V	630 VA
30 Hz	20V	40V	80V	160V	1000 VA
40 Hz	26.7V	53.5V	107V	214V	1400 VA
45 Hz to 5KHz	30V	60V	120V	240V	1500 VA
5KHz to 10KHz	30V	60V	120V	240V	750 VA
15 KHz	20V	40V	80V	160V	330 VA
20 KHz	15V	30V	60V	120V	167 VA

THEORY OF OPERATION

3.1 GENERAL

The California Instruments Model 1501T Power Source is an all silicon solid state 1500 VA amplifier and with companion oscillator is designed to provide reliable sine wave AC power over the frequency range from 45 Hz to 5 KHz.

A block diagram for the amplifier is shown in Figure 3-1. The pre-amplifier A1G1 is used to amplify the input signal to such a level so as to supply adequate drive to the power amplifier A1G2.

The power amplifier A1G2 provides the necessary sine wave signal to drive the output transformer T2. The output transformer has floating secondary windings which allow the load to float from the amplifier and oscillator circuitry.

The power amplifier A1G2 contains the overload and short circuit protection circuitry. A local negative feedback loop is taken from the output of the power amplifier back to the pre-amplifier, A1G1.

The overall negative feedback is taken from the feedback winding of the output transformer back to one input of the pre-amplifier via resistor A1R7. This feedback provides a closed loop gain of 20 from the high side of A1R5 to the primary of T2.

The positive feedback signal is generated by sensing the IR drop across the primary of T2 and applying this signal to transformer A1T1. Transformer A1T1 converts this differential signal into a single-ended signal and applies it to the input of the pre-amplifier through a divider network containing the regulation control R2. As this positive feedback is increased from zero with potentiometer R2, the output impedance of the power source is reduced toward zero.

The multiple secondary of transformer T2 is inner connected by means of a rear loaded printed circuit board, assembly A9. The rotation of this board is used to determine the output voltage range of the power source. This board also controls the front panel range lights and the range of the front panel voltmeter.

Power transformer T1, along with the associated rectifiers and filters, supply the operating voltages for the plug-in oscillator, the pre-amplifier A1G1, and the output amplifier A1G2.

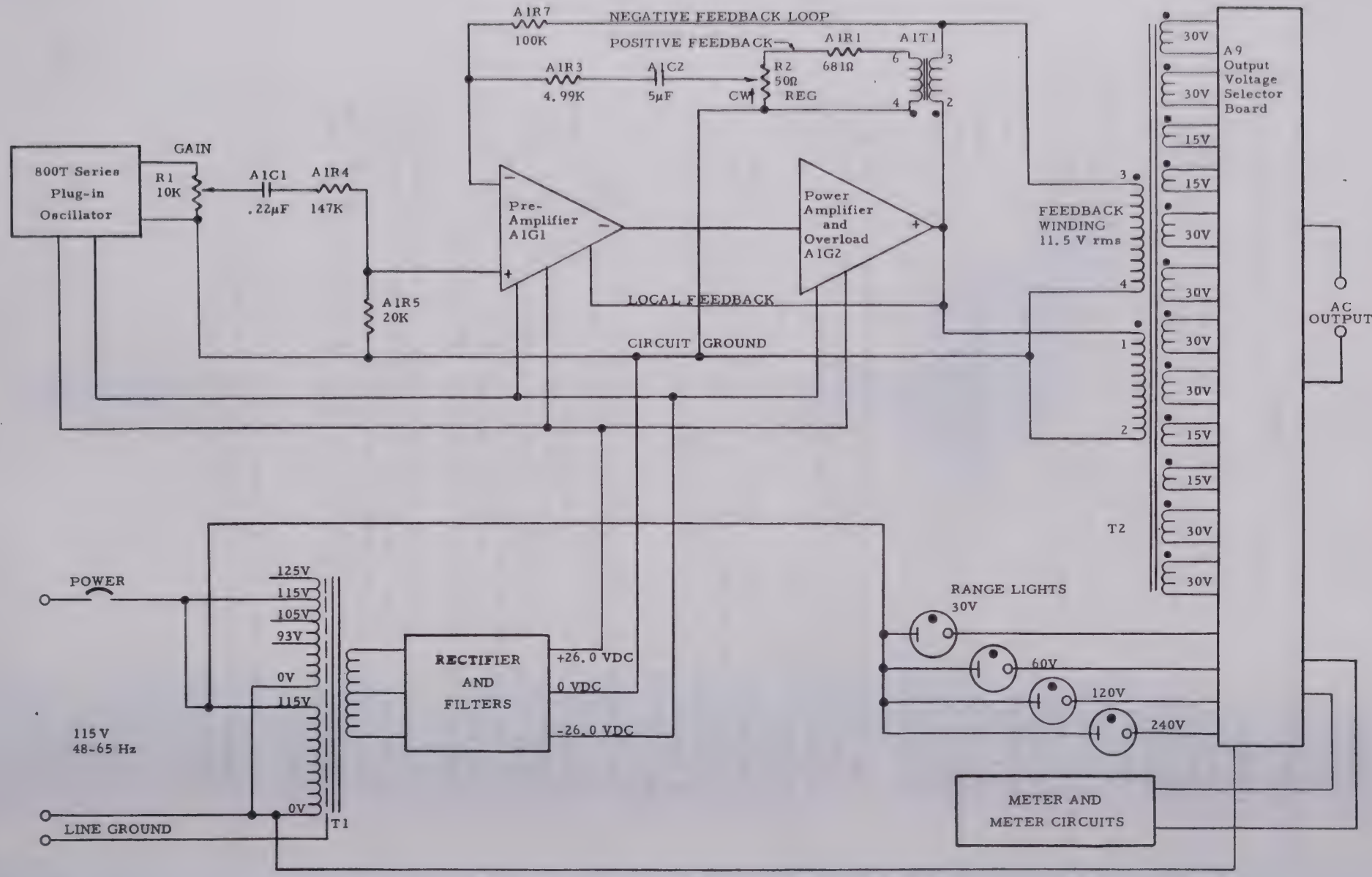


FIGURE 3-1. BLOCK DIAGRAM FOR MODEL 1501T POWER SOURCE.

3.2 DETAILED CIRCUIT DESCRIPTION

A schematic diagram for the Model 1501T Power Source is shown in drawing E4150-070, with the exception that the circuitry contained on the pre-amplifier circuit board (assembly A1), the meter board (assembly A6), the output voltage range selector board (assembly A9), and the plug-in oscillator. A schematic for the pre-amplifier circuit board is given in drawing D4100-071 and a schematic for the meter circuit is given in drawing B4050-072. A schematic for the range selector board is given in drawing D4120-071. For information on the plug-in oscillator, consult the applicable oscillator manual. These drawings give typical voltage levels and waveforms for the various sections of the power source.

3.2.1 PRE-AMPLIFIER

The pre-amplifier A1G1 is a part of the A1 assembly and consists of transistors A1Q1 through A1Q6 and associated components connected as a direct coupled differential amplifier. The open loop gain of this pre-amplifier is approximately 60 at 400 Hz and rolls off at 6 db per octave from 10 to 50 KHz.

Transistor A1Q1 is a dual field effect transistor used in the differential source follower configuration to provide a high input impedance and a gain of approximately 1.0. Potentiometer A1R11 is used to adjust the DC bias at the primary of T2 to zero volts with no signal.

Transistor A1Q2 is a dual transistor used in a differential configuration and provides a gain of approximately 15 at 400 Hz. Capacitor A1C6 and resistor A1R20B provide a high frequency step roll off from 10 KHz to 50 KHz.

Transistor A1Q3 and associated components are connected as a constant current source which provides the emitter current for A1Q2. This current source is designed to sink 2 milliamperes from the junction of A1R14 and A1R15 to the -10 volt supply.

Transistors A1Q4, A1Q5 are used in the differential amplifier configuration and provide an open loop gain of 4 at 400 Hz.

Transistor A1Q6 and associated components are connected as a constant current source which provides 8 milliamperes to the junction of A1R19B and A1R21B.

3.2.2 POWER AMPLIFIER

The power amplifier A1G2 mechanically consists of the remainder of the A1 board and the large heatsinks designated as the A2 through A5 assemblies. Electrically, the power amplifier consists of transistors A2Q1 through A2Q10, A3Q1 through A3Q10, A4Q1 through A4Q10, A5Q1 through A5Q10, A1Q7 through A1Q12 and associated components.

Transistor A1Q7 and associated components are connected as a constant current source which provides 30 milliamperes to bias the output stage by means of diodes A1CR8, A1CR9, A1CR10 and A1R58. This allows the output stage to operate as a Class A amplifier for no load or low VA load conditions and to operate nearly as a Class B amplifier for large load conditions.

Transistor A1Q9 and associated components are connected in the grounded emitter configuration. Local negative feedback is provided by A1C9, A1C11, A1C12, A1R41 and A1R42. The local feedbacks limits the gain of this stage to 15 at 400 Hz. The gain falls off at 6 db per octave from 10 KHz to 100 KHz.

The positive polarity output amplifier is contained on the A2 and A3 assemblies and consists of A2Q1 through A2Q10 and A3Q1 through A3Q10 connected as emitter followers. These transistors supply a total of 220 amperes peak during the positive one-half cycle of the output waveform when the power source is loaded to 1500 VA output at 91.6 per cent of rated output voltage (worst case condition within specification limits). These positive output amplifier transistors and their associated heatsinks can dissipate over 1500 watts with less than a 45°C case temperature rise with an air flow of 100 cfm per heatsink.

The negative polarity output amplifier is contained on the A4 and A5 assemblies and consists of A4Q1 through A4Q10 and A5Q1 through A5Q10 connected in the quasi-complementary symmetry configuration. These transistors supply a total of 220 amperes peak during the negative one-half cycle of the output waveform when the power source is loaded to 1500 VA output at 91.6 per cent of rated output voltage (worst case condition within specification limits). These negative output amplifier transistors and their associated heatsinks can dissipate over 1500 watts with less than a 45°C case temperature rise with an air flow of 100 cfm per heatsink.

When the power source is delivering its full rated output voltage the primary of the output transformer has an 11.5 volt rms signal.

3.2.3 OVERLOAD PROTECTION

The overload protection circuitry is shown in drawing D4100-071 and consists of A1Q11, A1Q12 and associated components.

Transistor A1Q12 and associated components are connected as a clamp circuit which is used to protect the positive polarity output amplifier (assemblies A2 and A3) during periods of overload or short circuit. This is accomplished by sensing the load current flowing through A2R3 and applying the resultant voltage drop to the emitter-base junction of A1Q12 through a suitable attenuator network. During periods of overload, the emitter-base junction of A1Q12 is forward biased sufficiently to allow the

collector circuit of A1Q12 to conduct a significant portion of the base drive normally available to A2Q1. This limits the base drive to A2Q1 and hence limits the available current from the positive polarity output amplifier during periods of overload. Potentiometer A1R54 is used to set the current level where the overload protection circuit is activated.

Transistor A1Q11 and associated components are used in a similar fashion to protect the negative polarity output amplifier (assemblies A4 and A5). The only differences are that the control voltage for A1Q11 is sensed across A4R11 and potentiometer A1R57 is used to set the overload current level.

The rated VA output of the power source is, to a large extent, determined by the power dissipation in the quasi-complementary symmetry output stage. This power dissipation is determined by the power factor of the load, the output VA level of the amplifier, and to the actual output voltage expressed as a percentage of the rated output voltage. The derating chart, given in the specifications, expresses this derating in a graphical form.

The design of the overload circuitry is such that the overload level is determined by the same three parameters that determine the power dissipation in the push-pull output stage. Resistors A1R48, A1R49, A1R51, A1R52, A1R55 and A1R56 have been selected so that the overload protection circuit and the power factor derating chart track one another quite closely in the region between 0 volts output and 91.6 per cent of rated output voltage. In the region between 91.6 per cent of rated output voltage and 100 per cent of rated output voltage, the rated VA output of the power source is limited by an arbitrary rating and as a result, the overload circuit allows a somewhat greater power output than that specified for the power source. The unit will be reliable in this mode of operation; however, output distortion and/or other specifications may be excessive.

3.2.4 OVERLOAD INDICATOR LAMP

The front panel indicator lamp is activated by transistor A1Q10 and associated components. The emitter-base junction of A1Q10 is driven from the voltage developed across A2R3 through a suitable attenuator network. Potentiometer A1R53 is adjusted at the factory so that the overload lamp DS1 is activated at the same time that the overload protection transistors A1Q11 and A1Q12 are activated.

3.2.5 INITIAL START UP PROTECTION

Triac A1Q8, capacitor A1C8, and associated components are connected as an electronic switch which is used to protect the positive polarity power amplifier (assembly A2 and A3) during initial application of AC power to the input of the Model 1501T Power Source. As capacitor A1C8 is charged to +25 volts from the +25 volt power supply, the gate of A1Q8 is biased "ON".

This, in turn, causes the maximum value of the voltage at the base of A2Q1 to be clamped to approximately +1.0 volt. This, in turn, limits the output current of the positive polarity amplifier (assemblies A2 and A3) to a negligible value during start-up conditions. As transistor A1Q9 begins to conduct, the load current through the triac A1Q8 drops below the minimum value of "holding current" and A1Q8 is switched off.

3.2.6 OVERALL NEGATIVE FEEDBACK

The overall negative feedback loop is a single-ended potentiometric feedback loop taken from the negative feedback winding of T2 back to the gate of A1Q1B. The feedback network consists of R2, A1R3, A1R7 and A1C2 and limits the mid-band closed loop voltage gain of the amplifier to 20 from the gate of A1Q1A to the primary T2.

This overall feedback loop provides approximately 20 db of negative feedback over the range from 45 Hz to 10 KHz. The feedback rolls off at approximately 9 db per octave for frequencies greater than 10 KHz. The purpose of this feedback loop is to insure that the frequency response, distortion, gain and amplitude stability specifications are met and/or exceeded.

A low frequency negative feedback loop is taken from the power primary winding of T2 back to the gate of A1Q1B through A1R8 and A1R9. This loop limits the closed loop voltage gain of the amplifier to 1.5 at DC and thereby provides improved DC bias stability for the amplifier.

3.2.7 POSITIVE CURRENT FEEDBACK

The positive current feedback loop generates a positive feedback voltage proportional to the load current in the secondary of T2. This is accomplished in the following fashion:

The load current in the secondary of the output transformer T2 is reflected back into the power primary winding producing an IR drop across the power primary winding. The negative feedback winding is connected so as to buck out the $L\frac{di}{dt}$ drop in the power primary winding. The remaining differential signal is applied to the primary of transformer A1T1 and converted into a single-ended signal at the secondary of A1T1. This signal is then applied to the gate of A1Q1B through a divider network consisting of A1R1, A1R2, A1R3, R2, A1C2 and A1C3. Potentiometer R2, which is accessible from the front panel of the unit, is used to adjust the amount of positive feedback and thereby adjust the output impedance of the power source.

3.2.8 POWER SUPPLY

A schematic diagram for the DC power supply is part of drawing E4150-070. This power supply delivers ± 26.0 volts ± 5 per cent at 64 amperes DC with less than 3.5 volts peak-to-peak ripple

from the 115 volt, 60 Hz AC line. Under no load conditions the ±26 volt supplies will deliver approximately ±32 volts DC from the the 115 volt 60 Hz AC line. These unregulated supplied consist of rectifier diodes A7CR1 through A7CR4 and filter capacitors A8C1 through A8C8 connected in a conventional fashion.

3.2.9 FRONT PANEL METER

The front panel meter M1 has a full scale sensitivity of 0 to 1 milliampere DC and an internal resistance of approximately 100 ohms. The meter has four scales with full scale ranges of 0 to 40 volts AC, 0 to 80 volts AC, 0 to 160 volts AC and 0 to 320 volts AC. The meter rectifiers and scaling circuitry are mounted on the rear of the meter.

The meter circuitry is designated as the A6 assembly and is shown in drawing B4050-072. This circuitry consists of rectifier diodes A6CR1 through A6CR4, potentiometer A6R1 and associated components. The four rectifier diodes are connected so as to form a full wave bridge rectifier. Potnetiometer A6R1 is used to shunt a small portion of the meter current and provide a sensitivity adjustment on the 40 volt scale. Resistors A6R3, A6R4 and A6R5 are set at the factory to provide proper tracking on the 320 volt, 160 volt and 80 volt ranges, respectively.

The meter range is automatically switched as the rotation of the rear loaded voltage range board is changed. The 40 volt full scale range of the meter is used with the 0-30 volt range of the power source, the 80 volts full scale range of the meter is used with the 0 to 60 volt range of the power source, the 160 volt full scale range of the meter is used with the 0 to 120 volt range of the power source, and the 320 volt full scale range of the meter is used with the 0 to 240 volt range of the power source.

3.2.10 OUTPUT VOLTAGE RANGE

The output voltage range is controlled by the rotation of printed circuit board A9. A schematic for this printed circuit board is shown in drawing D4120-071. The primary purpose of this printed circuit board is to interconnect the multiple secondary windings of T2 in various fashions depending on the desired output voltage range. Table 3-1 on the following page illustrates this interconnection.

TABLE 3-1

OUTPUT VOLTAGE RANGE	INTERCONNECTION
0 to 30 volts rms	S3 and S4 are connected in the series aiding configuration; S9 and S10 are connected in the series aiding configuration; each of these two sets of windings are then connected in parallel with S1, S2, S5, S6, S7, S8, S11 and S12 to provide the 0 to 30 volt output.
0 to 60 volts rms	S2 is in parallel with S1; S6 is in parallel with S5; S8 is in parallel with S7; and S12 is in parallel with S11. S3, S4, S9 and S10 are connected in the series aiding configurations; S1 and S5 are connected in the series aiding configuration; S7 and S11 are connected in the series aiding configuration. These three configurations are in parallel to provide the 0 to 60 volt output.
0 to 120 volts rms	S2 is in parallel with S1; S6 is in parallel with S5; S8 is in parallel with S7; S12 is in parallel with S11: S3, S4, S9 and S10 are not used. S1, S5, S7 and S11 are connected in the series aiding configuration to provide the 0 to 120 volt output.
0 to 240 volts rms	S3, S4, S9 and S10 are not used. S1, S2, S5, S6, S7, S8, S11 and S12 are connected in the series aiding configuration to provide the 0 to 240 volt output.

CAUTION

HIGH VOLTAGE (250 VAC)

Voltages up to 250 VAC are available in certain sections of this power source. This equipment generates potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions. Do not touch electronic circuits when power is applied. Avoid contact with pin C and pin D of the plug-in oscillator, the primary power circuits, and the output circuits of the power source.

CALIBRATION PROCEDURE

4.1 GENERAL

The following calibration procedure, or any part of it, may be performed on a routine basis to insure that the Model 1501T Power Source remains within specified tolerances. This procedure should always be performed after any repairs have been made to the unit. This procedure also covers test methods for the following power source adjustments and specifications:

a) Initial Adjustments.

b) AC Line Input Power and Overload Adjustment.

c) Voltage, Power Output and Harmonic Distortion.

d) Line Regulation.

e) Load Regulation Adjustment.

f) Amplitude Stability.

g) Frequency Response.

h) AC Noise Level.

i) 0.7 Lagging Power Factor.

j) 0.7 Leading Power Factor.

This calibration procedure assumes that the power source will be operated from the 230 volt 47 to 65 Hz AC line. For operation from the 115 volt AC line, a 120 volt variac and a 120 volt wattmeter must be substituted for those called out in this procedure. Consult Section 2.2.1 of this instruction manual for operation from other than the 230 volt AC line.

This calibration procedure further assumes that the power source is tested on the 0 to 120 volt range. Performance is very similar on the other three ranges. The following table illustrates the change in measurement voltage and impedance level when evaluating the power source on various output voltage ranges.

TABLE 4-1				
Rated Output Voltage	30 VAC	60 VAC	120 VAC	240 VAC
91.6% of Rated Output Voltage	27.5 VAC	55.0 VAC	110 VAC	220 VAC
Resistance Load for 1500 VA Output at Rated Output Voltage	0.60 Ω	2.40 Ω	9.6 Ω	38.4 Ω
Resistance Load for 1500 VA Output at 91.6% of Rated Output Voltage	0.505 Ω	2.02 Ω	8.08 Ω	32.3 Ω

Section 2.4 of this instruction manual indicates the procedure required to change output voltage ranges and Section 2.8 indicates some potential problems associated with output wiring IR drop on the low voltage ranges. When checking load regulation and amplitude stability, care should be taken to use a four-wire connection such that the external load and the measurement equipment have completely separate wiring from the large AC output terminal strip located at the rear of the power source.

4.2 TEST EQUIPMENT REQUIRED

The following test equipment is required to perform the calibration procedure assuming that the input voltage has a nominal value of 230 volts rms and that the power source is tested on the 0 to 120 volt AC range. Some equipment substitutions will be required if this is not the case.

a) Oscilloscope, Tektronix 533 with "W" plug-in.

b) 10.0 KVA Variac, General Radio 2XW50M or equivalent.

c) 5.0 KVA Wattmeter, Simpson Electric or equivalent.

d) Distortion Analyser, H.P. 330B or equivalent.

e) Differential Voltmeter, Fluke 883A or equivalent.

f) Multi-range 1500 watt load box, or individual 1500 watt power resistors, as defined in Table 4-1. Dale type NHL resistors or equivalent.

g) Expanded Scale (about 115 VAC) strip chart recorder, Voltron Model 89.038 or equivalent.

h) Multimeter, Simpson 260 or equivalent.

4.3 INITIAL ADJUSTMENTS

4.3.1 Connect the Model 1501T Power Source as shown in Figure 4-1. Turn the GAIN control fully counter-clockwise. Adjust the line voltage to its nominal value with the variac. Turn the POWER switch "on". The wattmeter should indicate 400 watts or less at nominal line voltage. If a problem is encountered, perform step 4.3.2 below.

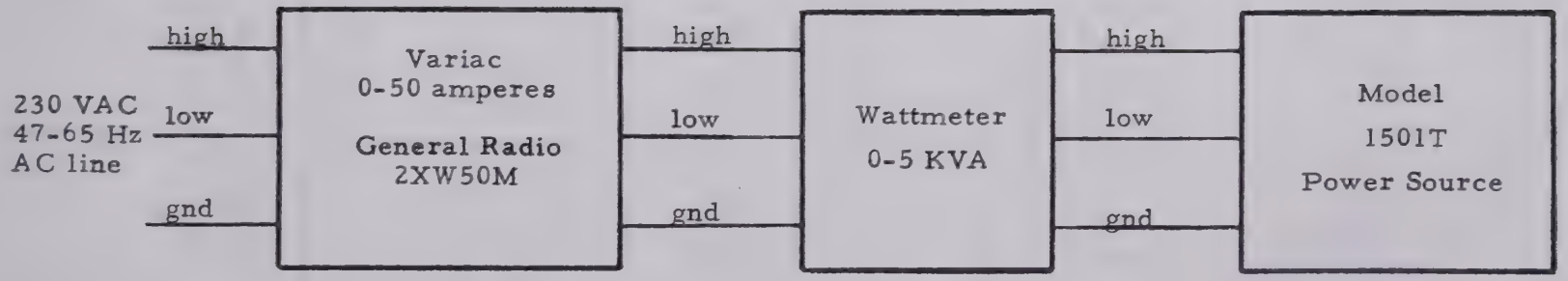
4.3.2 Turn the unit on its side and remove the bottom cover. Connect the differential voltmeter between terminal 1 and terminal 2 of T2. Adjust potentiometer A1R11 so that the DC voltage across the primary of T2 is 0.00 volts ± 5 millivolts. This balances and minimizes the collector current in both halves of the output stage. If the input power is still excessive, reduce the size of resistor A1R58 somewhat.

4.3.3 Connect the differential voltmeter to the power output terminals at the rear of the unit and select the 0 to 30 volt range with the rear loaded printed circuit board. Adjust the GAIN control for a 30 volt output with the oscillator set to 400 Hz. Adjust the meter calibration control A6R1 so that the front panel meter and the differential voltmeter correlate within one per cent of each other. Vary the frequency from 45 Hz to 5 KHz and check that the front panel meter reads within ± 3 per cent of the correct value.

4.3.4 Remove power from the unit and select the 0 to 60 volt range with the rear loaded printed circuit board. Set the oscillator to 400 Hz and adjust the output to exactly 60 volts while reading the differential voltmeter. Select resistor A6R5 so that the front panel meter and the differential voltmeter correlate within one per cent. Vary the frequency from 45 Hz to 5 KHz and check that the front panel meter reads within ± 3 per cent of the correct value.

4.3.5 Remove power from the unit and select the 0 to 120 volt range with the rear loaded printed circuit board. Set the oscillator to 400 Hz and adjust the output to exactly 120 volts while reading the differential voltmeter. Select resistor A6R4 so that the front panel meter and the differential voltmeter correlate within one per cent. Vary the frequency from 45 Hz to 5 KHz and check that the front panel meter reads within ± 3 per cent of the correct value.

4.3.6 Remove power from the unit and select the 0 to 240 volt range with the rear loaded printed circuit board. Set the oscillator to 400 Hz and adjust the output to exactly 240 volts while reading the differential voltmeter. Select resistor A6R3 so that the front panel meter and the differential voltmeter correlate within one per cent. Vary the frequency from 45 Hz to 5 KHz and check that the front panel meter reads within ± 3 per cent of the correct value.



See Table 2-1 for AC line input wiring to the Model 1501T Power Source. Unit is normally wired for 230 ± 20 volts AC line operation.

FIGURE 4-1. Test set up for initial adjustment of Model 1501T Power Source.

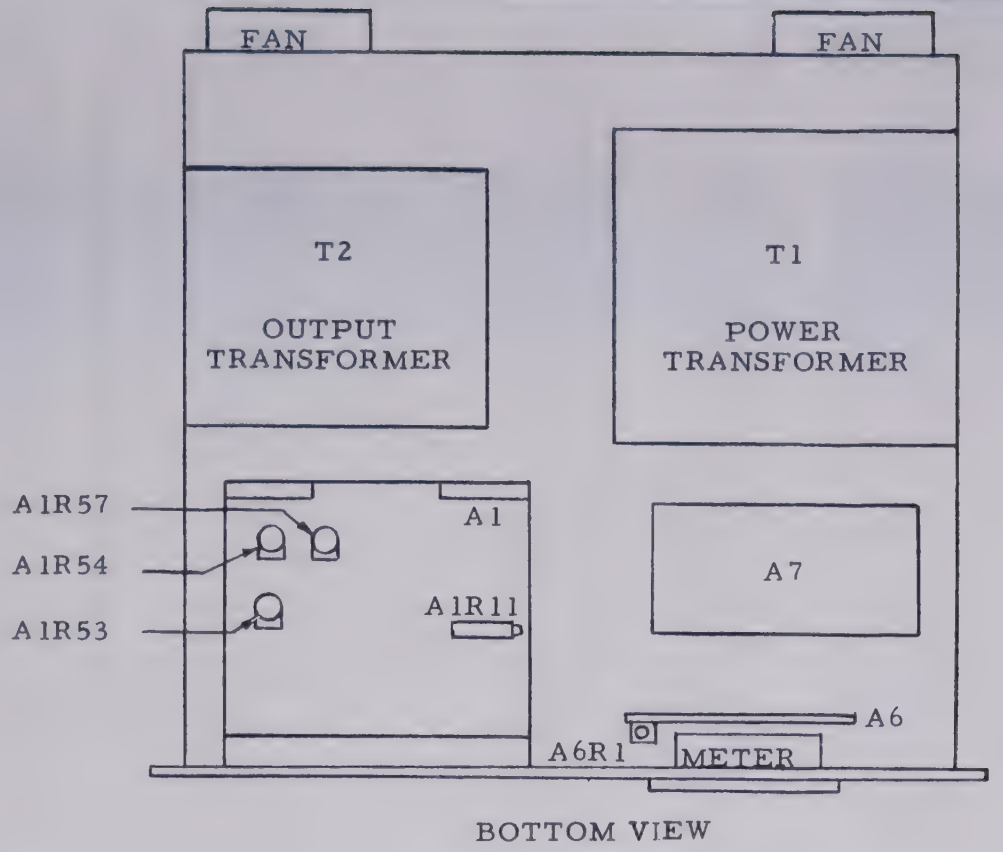


FIGURE 4-2. Internal Adjustments for Model 1501T Power Source.

4.4 AC LINE INPUT POWER AND OVERLOAD ADJUSTMENT

4.4.1 Connect the Model 1501T Power Source as shown in Figure 4-3. Select the 120 volt range and adjust the output voltage of the power source to 110 volts rms (91.6 per cent of rated output voltage) at 400 Hz. Close switch S2 (8.08 ohm load) and readjust the output voltage slightly, if required, in order to maintain a 110 volt output. The power source should deliver a clean sine wave output with less than 0.30 per cent distortion. Vary the frequency from 45 Hz to 5 KHz and check that the distortion does not exceed 0.50 per cent at 5 KHz over the AC input line voltage range of 210 to 250 volts while maintaining the output voltage at 110 volts rms. Adjust potentiometer A1R54 so that no clipping or excessive distortion occurs on the positive peak of the output waveform under worst case conditions outlined above. Adjust potentiometer A1R57 so that no clipping or excessive distortion occurs on the negative peak of the output waveform under worst case conditions outlined above. These two adjustments may interact somewhat, so care should be taken not to move one adjustment excessively without checking the effect on the other adjustment.

4.4.2 With the AC input line voltage adjusted to its maximum value (normally 250 volts AC), close switch S2 and set the output voltage to 110 volts rms at 400 Hz. The AC line wattmeter should indicate less than 5200 watts.

4.4.3 Repeat step 4.4.2 except close switch S1 instead of S2 and set the output voltage to 120 volts rms (100 per cent of rated output voltage). Maintain the input AC line voltage at 250 volts rms. The AC line wattmeter should indicate less than 4800 watts.

4.4.4 Repeat step 4.4.2 except open switch S1 (no load on output of power source). The AC line wattmeter should indicate less than 500 watts with a line voltage of 250 volts rms.

4.4.5 This procedure may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit board should be rotated to provide the proper output voltage range. The load impedance and output voltage levels should be taken from those given in Table 4-1.

4.5 VOLTAGE, POWER OUTPUT AND HARMONIC DISTORTION

4.5.1 Connect the Model 1501T Power Source as shown in Figure 4-3. Select the 120 volt range with the rear loaded printed circuit board. Adjust the variac to provide a 230 volt AC line input and allow the power source to warm up for a few minutes. Set the oscillator output to 400 Hz and adjust the output of the amplifier with the GAIN control to provide 120 volts rms (100% of rated output). Close switch S1 so that the 9.6 ohm load is across the output of the power source.

4.5.2 Vary the AC line voltage from 210 to 250 volts with the variac and check that no significant clipping is observed on the sine wave output with the oscilloscope. The harmonic distortion must be less than 0.3 per cent over the full line voltage range.

4.5.3 Set the oscillator output to 45 Hz and adjust the output of the power source to 120 volts rms with the GAIN control. Repeat step 4.5.2. The harmonic distortion must be less than 0.50 per cent over the full line voltage range.

4.5.4 Set the oscillator output to 600 Hz and adjust the output of the power source to 120 volts rms with the GAIN control. Repeat step 4.5.2. The harmonic distortion must be less than 0.30 per cent over the full line voltage range.

4.5.5 Set the oscillator output to 5 KHz and adjust the output of the power source to 120 volts rms with the GAIN control. Repeat step 4.5.2. The harmonic distortion must be less than 0.50 per cent over the full line voltage range.

4.5.6 Repeat steps 4.5.1 through 4.5.4 except set the output of the power source to 110 volts rms (91.6 per cent of rated output) and close switch S2 instead of S1. The harmonic distortion must be less than 0.30 per cent from 200 Hz to 600 Hz, and less than 0.5 per cent from 45 Hz to 5 KHz.

4.5.7 This procedure may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit board should be rotated to provide the proper output voltage range. The load impedance and output voltage levels should be taken from those given in Table 4-1.

4.6 LINE REGULATION

4.6.1 Connect the Model 1501T Power Source as shown in Figure 4-3. Select the 120 volt range with the rear loaded printed circuit board. Set the oscillator frequency to 400 Hz. Close switch S1 (9.6 ohm load) and adjust the output of the power amplifier to 120 volts rms (100 per cent of rated output voltage) at 400 Hz.

4.6.2 Vary the line voltage from 210 volts to 250 volts AC and measure the change in output voltage of the power amplifier. This change should be less than 0.60 volts rms.

4.6.3 Set the frequency of the oscillator to 5 KHz and repeat 4.6.1 and 4.6.2. The change in the output voltage should be less than 0.60 volts rms.

NOTE

Care should be taken to insure that the output amplitude of the oscillator remains stable and independent of line conditions during this test.

4.6.4 This procedure may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit board should be rotated to provide the proper output voltage range. The load impedance and output voltage level should be taken from those given in Table 4-1.

4.7 LOAD REGULATION ADJUSTMENT

The load regulation adjustment is accessible from the front panel of the power source and is usually adjusted for zero regulation at 400 Hz. This adjustment is somewhat sensitive to the output voltage range and should be readjusted whenever the output voltage range is changed.

4.7.1 Connect the Model 1501T Power Source as shown in Figure 4-3. Check that the load is connected to the large AC output terminals at the rear of the power source. The output voltage may be monitored either at the rear or the front of the power source. If it is monitored at the rear of the power source, care should be taken to use four-wire sensing. Adjust the output voltage of the Model 1501T Power Source to 110 rms output (91.6 per cent of rated output voltage) at 400 Hz.

4.7.2 Place the differential voltmeter on the 1000 volt AC range and connect it across the front panel output terminals of the power source. Adjust R2 (accessible from the front panel of the power source and labeled REG) so that the output voltage variation is less than 20 millivolts as the 8.08 ohm load is added and removed. Maintain the line voltage at 230 volts during this test.

4.7.3 Set the frequency of the oscillator to 5 KHz. Adjust the output amplitude of the power source to 110 volts rms with no load on the output of the power source. The output of the power source should change less than ± 1.10 volts when loaded with the 8.08 ohm resistor. Maintain the line voltage at 230 volts during this test. Capacitors A1C3 and A1R2, in the secondary circuit of A1T1, have been set at the factory for optimum load regulation in the 2 to 5 KHz region and may be changed, if required.

4.7.4 Set the frequency of the oscillator to 45 Hz and repeat 4.7.3. The output of the power source should change less than ± 1.10V.

4.7.5 This procedure (steps 4.7.1 through 4.7.4) may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit board should be rotated to provide the proper output voltage range. The load impedance and output voltage levels should be taken from those given in Table 4-1. Care should be taken to use non-inductive load resistors, especially on the 30 volt and 60 volt output voltage ranges where load impedances are very low and a few microhenries of inductance will significantly influence the power factor at 5 KHz. The load regulation must remain within a ± 1 per cent band from 45 Hz to 2 KHz and within a ± 2 per cent band from 45 Hz to 5 KHz on the 60 volt and 240 volt output ranges. The load regulation must remain within a ± 1 per cent band from 45 Hz to 1.0 KHz and within a ± 2 per cent band from 45 Hz to 2 KHz on the 30 volt range.

NOTE

Care should be taken to insure that the output amplitude of the oscillator remains stable and independent of load conditions during this test.

4.8 AMPLITUDE STABILITY

4.8.1 Connect the Model 1501T Power Source as shown in Figure 4-3. Adjust the AC input line voltage to 230 volts rms. Adjust the output of the power source to provide 115 volts rms output (95.8 per cent of rated output voltage) at 400 Hz. Connect a 8.8 ohm (1500 VA) load to the output terminals at the rear of the power source and check that the REG control has been set to provide a zero output impedance.

4.8.2 Connect an AC expanded scale (about 115 volts rms) strip chart recorder across the output terminals of the power source and record the drift during a 24 hour period. This drift should be less than ± 0.29 volts rms. Disregard the drift during the first hour, as this represents initial warm-up drift. Care should be taken to insure that the ambient temperature is held constant at ± 3 degrees centigrade for this test.

4.8.3 This procedure may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit board should be rotated to provide the proper output voltage range. The load impedance and output voltage level should be taken from those given in Table 4-1 consistent with the dynamic range of the specific expanded scale strip chart recorder employed for the test.

4.9 FREQUENCY RESPONSE

4.9.1 Connect the Model 1501T Power Source as shown in Figure 4-3. Adjust the input AC line voltage to 230 volts rms. Adjust the output of the power source to provide 120 volts output (100 per cent of rated output voltage) at 400 Hz.

4.9.2 Vary the output frequency of the oscillator from 45 Hz to 5 KHz and monitor the output voltage of the power source with a differential voltmeter under no-load conditions. The output of the power source should vary less than ± 7.5 volts rms from 45 Hz to 5 KHz.

4.9.3 Close switch S1 and repeat 4.9.1 and 4.9.2. The output of the power source should vary less than ± 7.5 volts rms from 45 Hz to 5 KHz.

4.9.4 This procedure may be performed for any of the other output voltage ranges, other than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit board should be

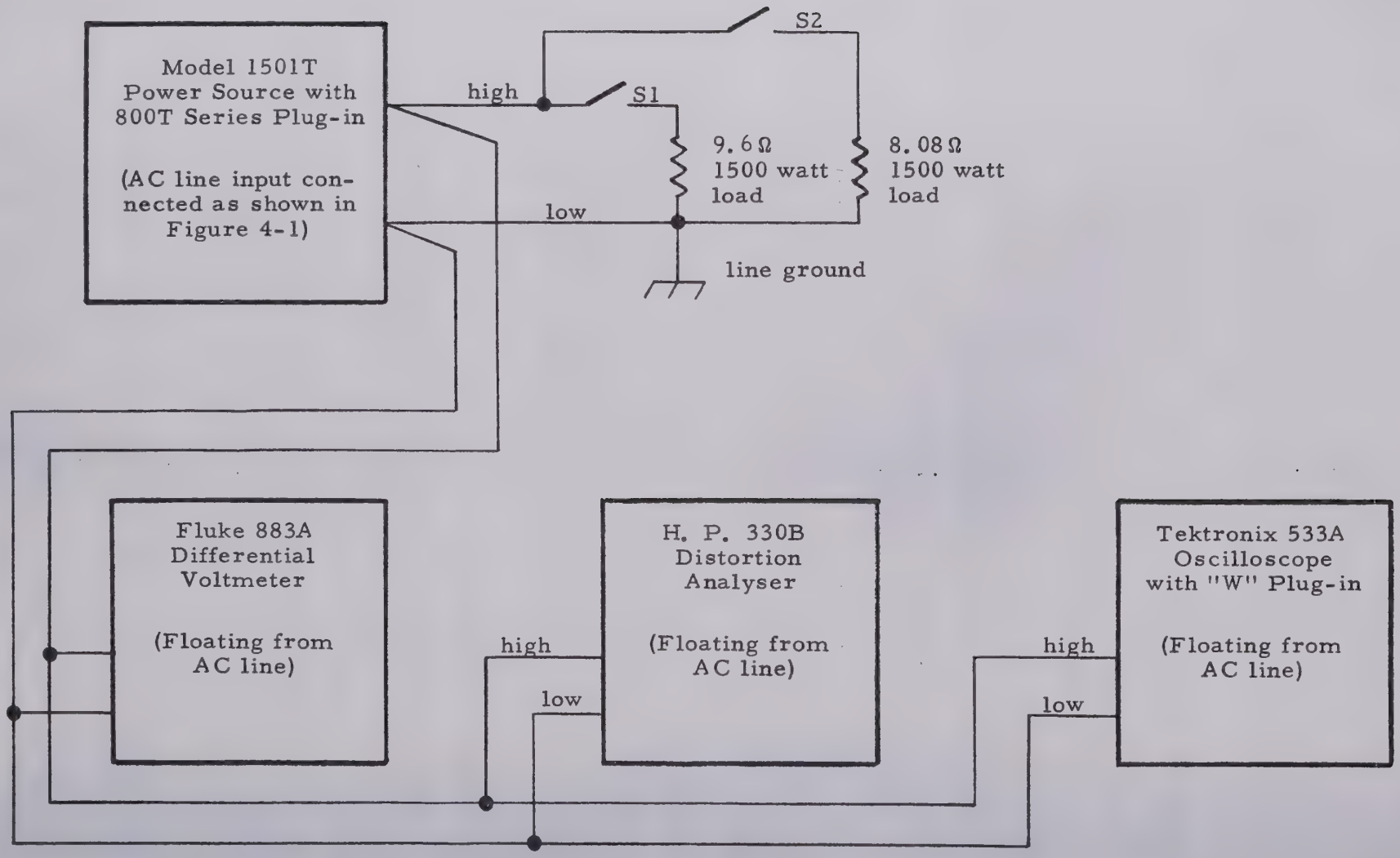


FIGURE 4-3. Test Circuit for Model 1501T Power Source.

rotated to provide the proper output voltage range. The load impedance and output voltage level should be taken from those given in Table 4-1. The output must vary less than ± 0.5 db from 45 Hz to 5 KHz.

4.10 AC NOISE LEVEL

4.10.1 Connect the Model 1501T Power Source as shown in Figure 4-3. Adjust the line voltage to 230 volts rms. Adjust the output of the power source to provide 110 volts rms (91.6% of rated output voltage) at 400 Hz.

4.10.2 Close switch S2 and monitor the output of the power source with the Tektronix 533A Oscilloscope with a "W" plug-in. Using the offset feature of the "W" plug-in, observe the positive peak of the output voltage at a vertical sensitivity of .2 volt per centimeter and a sweep rate of 5 milliseconds per centimeter. The peak-to-peak noise and ripple should not exceed 0.312 volts (60 db below full output). The noise and ripple output may be slightly greater if the power source is tested at an output frequency of less than 200 Hz.

4.10.3 Remove the plug-in oscillator and short pins 1 and 2 together of the terminal strip TB1 located on the rear panel of the Model 1501T. The AC rms noise in the output should now be less than 11.0 millivolts rms (80 db below full output) when read on the differential voltmeter. Remove the short from pins 1 and 2 of TB1 and then insert the plug-in oscillator into the 1501T.

4.10.4 Steps 4.10.1 through 4.10.3 may be performed on any of the other output voltage ranges, if desired. In this case, the rear loaded printed circuit board should be rotated to provide the proper output voltage range. The load impedance and output voltage level should be taken from those given in Table 4-1. The following chart gives the acceptable noise level output on each voltage range.

Rated Output Voltage	30 VAC	60 VAC	120 VAC	240 VAC
Peak-to-Peak Noise Level with 1500 VA Load (See 4.10.2)	0.078 V p-p	0.156 V p-p	0.312 V p-p	0.624 V p-p
RMS Noise Level at No Load (See 4.10.3)	2.75 mv rms	5.5 mv rms	11.0 mv rms	22 mv rms

4.11 0.7 LAGGING POWER FACTOR

4.11.1 Connect the Model 1501T Power Source as shown in Figure 4-3. Select the load circuit to correspond with the required output voltage range. Figure 4-4 illustrates the load circuit and gives load parameter values for 1500 VA 0.7 power factor at 400 Hz with 91.6 per cent of rated output voltage from the power source. This represents the worst case inductive load for maximum power dissipation inside the power source.

4.11.2 Set the oscillator frequency to 400 Hz and adjust the GAIN control for 91.6 per cent of rated output voltage. Check that the power source produces a stable output with no high-frequency oscillation or excessive distortion. Refer to Section 4.5 of this instruction manual for the procedure to measure harmonic distortion. This distortion must be less than 0.30 per cent at 400 Hz. The overload adjustments, A1R54 and A1R57, may have to be rotated counterclockwise slightly with a 0.7 power factor load to meet the 0.30 per cent distortion specification.

4.11.3 The REG control usually does not require significant readjustment in order to provide a zero regulation with a 0.7 power factor load at 400 Hz. If the unit is to be operated at a 0.7 power factor in the high frequency region, i.e., 2 KHz to 5 KHz, then it may be necessary to readjust the REG control. In this case, rotate the front panel REG control until zero regulation is obtained at the specific frequency and load condition.

4.11.4 The AC input power is 5200 watts maximum with an 0.7 power factor load at 91.6 per cent of rated output voltage and an input line voltage of 250 volts rms.

4.11.5 The above tests may be repeated at frequencies other than 400 Hz provided that the inductance of the series inductor is changed inversely proportional to the absolute value to the test frequency. For example, at 1 KHz the inductance value must be divided by 2.5. The series resistance value remains unchanged.

4.12 0.7 LEADING POWER FACTOR

4.12.1 Connect the Model 1501T Power Source as shown in Figure 4-3. Select the load circuit to correspond with the required output voltage range. Figure 4-5 illustrates the load circuit and gives load parameter values for 1500 VA 0.7 power factor operation at 400 Hz with 91.6 per cent of rated output voltage from the power source. This represents the worst case capacitive load for maximum power dissipation inside the power source.

4.12.2 Set the oscillator frequency to 400 Hz and adjust the GAIN control for 91.6 per cent of the rated output voltage. Check that the power source produces a stable output with no high frequency oscillation or excessive distortion. Refer to Section 4.5 for the procedure to measure harmonic distortion. This distortion must be less than 0.30 per cent at 400 Hz. The overload adjustments, A1R54 and A1R57, may have to be rotated counterclockwise slightly with a 0.7 power factor load to meet the 0.30 per cent distortion specification.

4.12.3 The REG control usually does not require significant readjustment in order to provide a zero regulation with a 0.7 power factor load at 400 Hz. If the unit is to be operated at a 0.7 power factor in the high frequency region, i.e., 2 KHz to 5 KHz, then it may be necessary to readjust the REG control. In this case, rotate the front panel REG control until zero regulation is obtained at the specific frequency and load condition.

4.12.4 The AC line input power is 5200 watts maximum with an 0.7 power factor load at rated output voltage and an input line voltage of 250 volts rms.

4.12.5 The above tests may be repeated at frequencies other than 400 Hz provided that the capacitance of the series capacitor is changed inversely proportional to the absolute value of the test frequency. For example, at 1 KHz the capacitance value must be divided by 2.5. The series resistance value remains unchanged.

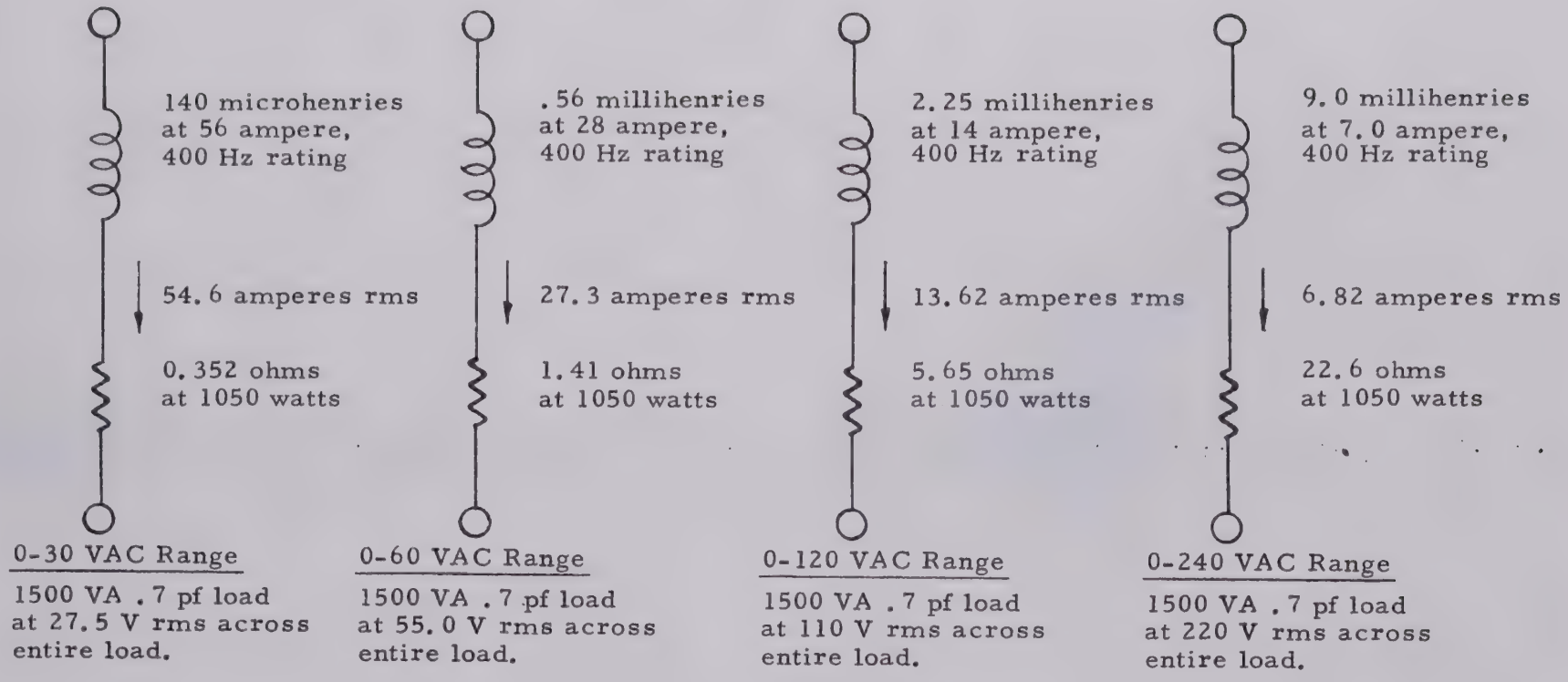


FIGURE 4-4. Load Circuit for 0.7 Lagging Power Factor at 400 Hz.

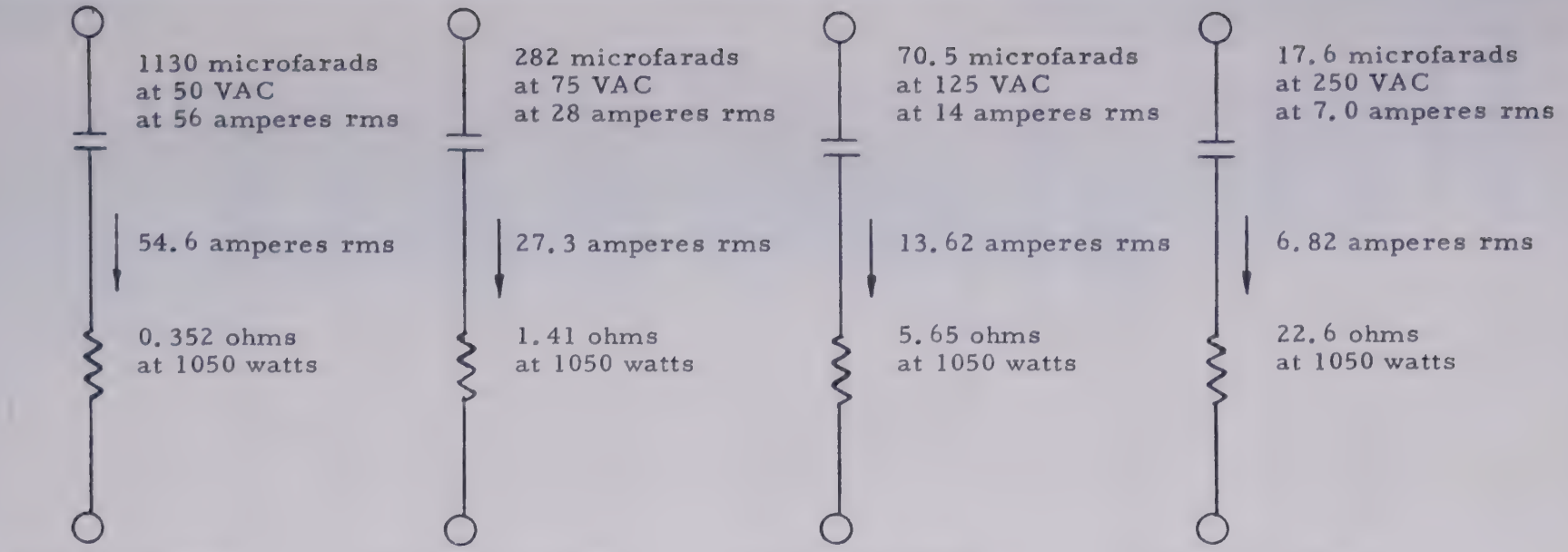


FIGURE 4-5. Load Circuit for 0.7 Leading Power Factor at 400 Hz.

MAINTENANCE AND TROUBLE SHOOTING

5.1 GENERAL

The California Instruments Model 1501T Power Source is a solid state unit and should require a minimum of maintenance. However, it is forced air cooled and will accumulate some dust with time. The power transistor heatsinks should receive a forced air bath at intervals not to exceed six months.

CAUTION

Failure to keep the heatsinks clean will reduce their thermal transfer efficiency somewhat and could cause failure of the power source.

5.2 TROUBLESHOOTING

5.2.1 If a problem appears in the power source, it must be isolated to a specific section of the unit. Before servicing the amplifier, check that the AC power input to the unit is of the proper amplitude and frequency. Check that the signal input to the power amplifier is also of the proper amplitude (approximately 5 volts rms) and frequency (45 Hz to 5 KHz). Check that the output load on the power amplifier is not excessive or that the load starting transients are not excessive. Check that the output of the oscillator is coupled to the input of the power amplifier through the 12 pin connector on the rear of the power amplifier.

5.2.2 If the problem has been resolved to be in the power amplifier, first check all DC power supply voltages. Information concerning power supply ripple and voltage tolerance is given in Section 3.2.8 of this instruction manual.

5.2.3 Check that the quasi-complementary symmetry output amplifier is operating properly and is not drawing excessive current under no load conditions. Section 3.2.2 of this instruction manual describes the operation of this output amplifier.

5.2.4 Check that the overload circuitry is operating properly. The overload circuit may be disabled by removing A1CR13 and A1CR14.

5.2.5 If the problem has been resolved to be in the oscillator, consult the applicable oscillator instruction manual.

CIRCUIT DIAGRAMS

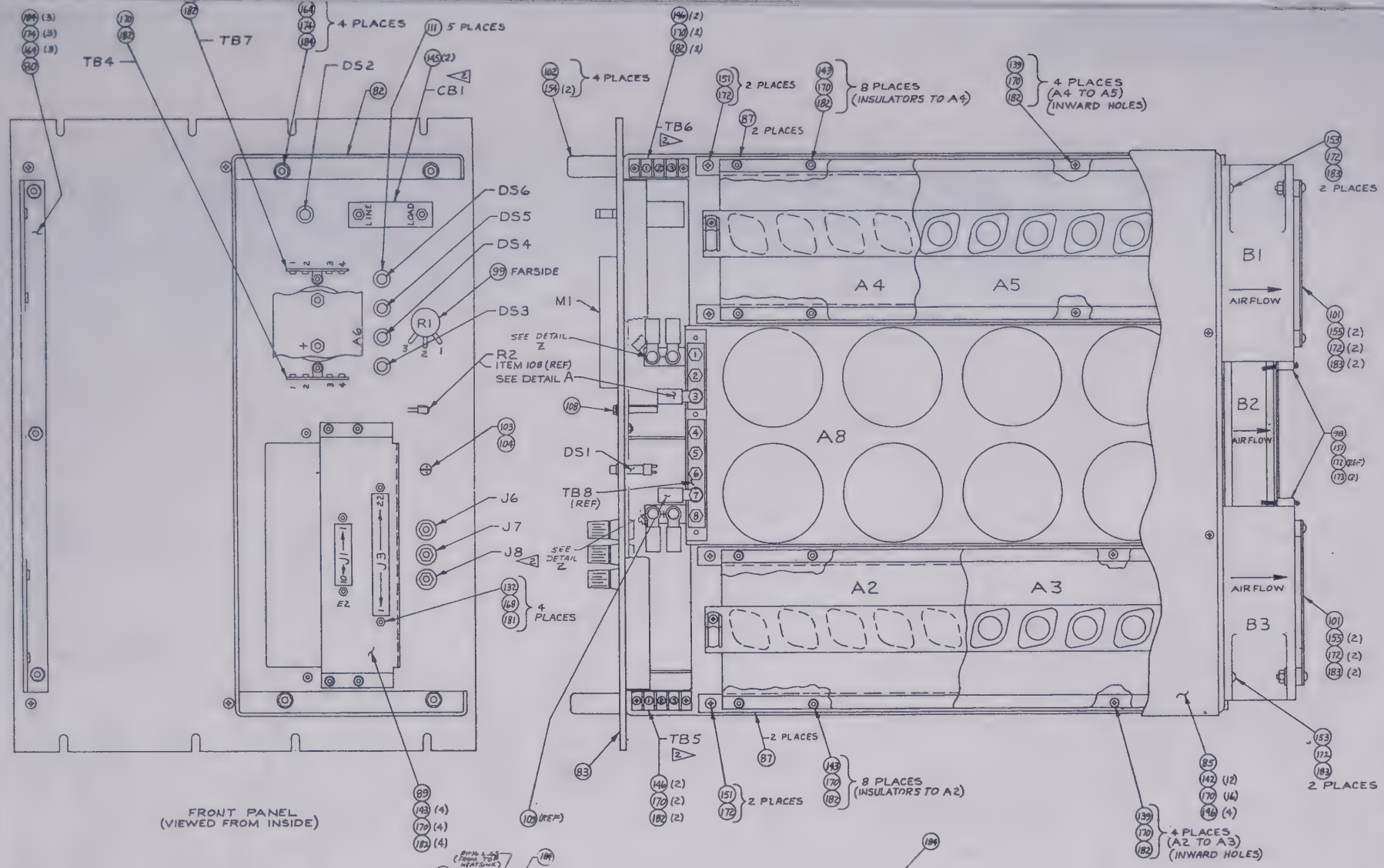
6.1 GENERAL

This section contains schematics and mechanical diagrams necessary for operation and maintenance of the Model 1501T AC Power Source. The schematic diagrams illustrate the circuit while the mechanical assemblies indicate the part placement.

6.2 REFERENCE DESIGNATIONS

Partial reference designators are shown on schematic and mechanical drawings. Prefix these reference designators with assembly and/or sub-assembly designation for the complete reference designator. For example:

Assembly/Sub-Assembly	Component	Component Designation
A1	C14	A1C14
None	T1	T1
A2	R1	A2R1



1. SECURE WIRES TO TERM 1 & TERM 2 PIGTAIL BY SHRINK TUBING OR BLACK ELEC. TAPE IN AREA SHOWN.
2. ROTATE B1, B2 & B3 SO WIRE TERMINALS ARE ADJACENT TO GROMMET FOR INTERNAL WIRING.
4. FOR WIRE TAB TABLE SEE DWG NO. 4100-050
3. FOR SCHEMATIC SEE DWG. NO. E4150-070
5. SEE WTT 4100-050 FOR SPECIFIC CRIMP LUG REQUIREMENTS.
6. CEMENT TO ITEM 82 USING ITEM 110

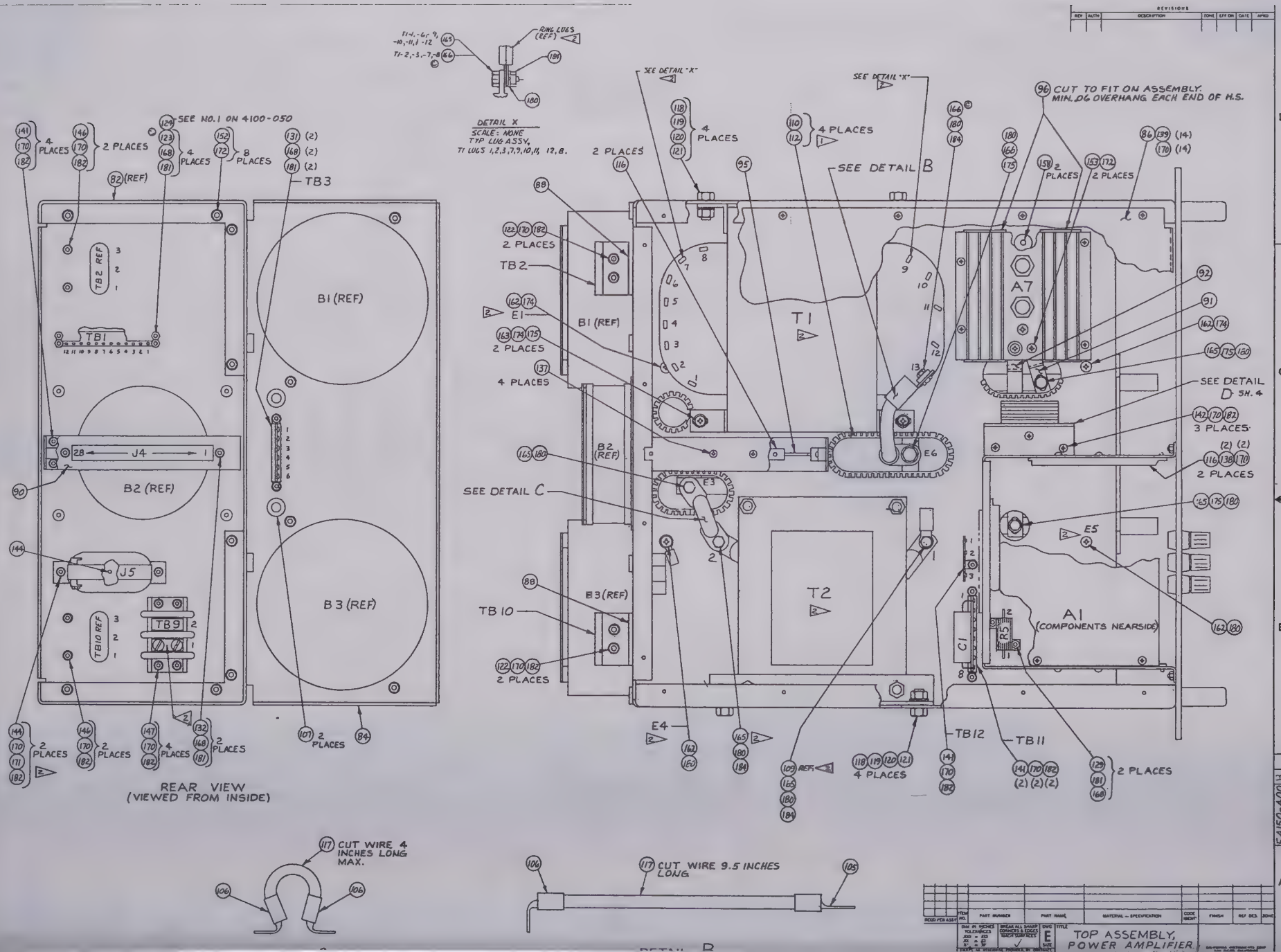
FOR PARTS LIST SEE SHEET 5 OF 10.

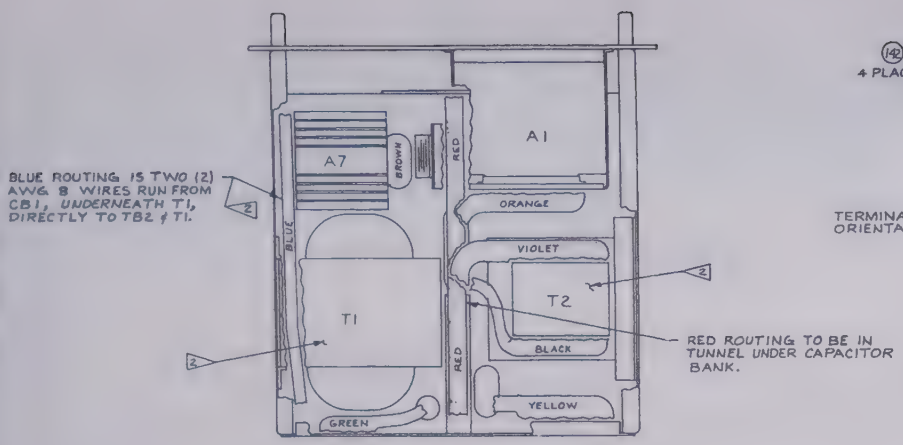
TOP ASSEMBLY, POWER AMPLIFIER

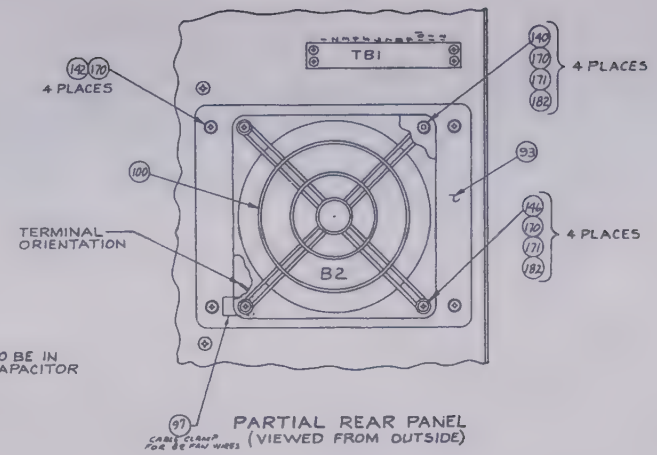
MODEL 1501I

E4150-400 B

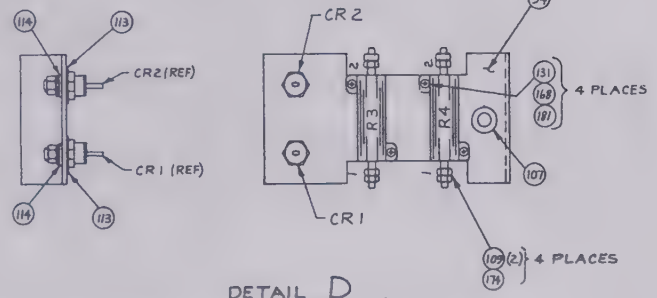
E4150-400 A


REVISIONS
REV
AUTH
DESCRIPTION
ZONE
ECP NO.
DATE
APPD
DETAIL X
SCALE: NONE
TYP LUG ASSY,
T1 LUGS 1,2,3,7,9,10,11, 12,8.
RING LUGS (REF)
T1-4,-6,-9, -10,-11,-12
T1-2,-3,-7,-8
SEE NO.1 ON 4100-050
4 PLACES
2 PLACES
8 PLACES
TB3
TB2 REF
TB1
TB10 REF
TB9
B1 (REF)
B2 (REF)
B3 (REF)
J4
J5
REAR VIEW
(VIEWED FROM INSIDE)
SEE DETAIL "X"
SEE DETAIL B
SEE DETAIL C
SEE DETAIL D SH. 4
CUT TO FIT ON ASSEMBLY. MIN. DG OVERHANG EACH END OF H.S.
T1
T2
A7
A1
(COMPONENTS NEARSIDE)
E1
E3
E4
E5
E6
TB2
TB10
TB11
TB12
C1
R5
3 PLACES
CUT WIRE 4 INCHES LONG MAX.
CUT WIRE 9.5 INCHES LONG
TOP ASSEMBLY, POWER AMPLIFIER
E4150-400 B

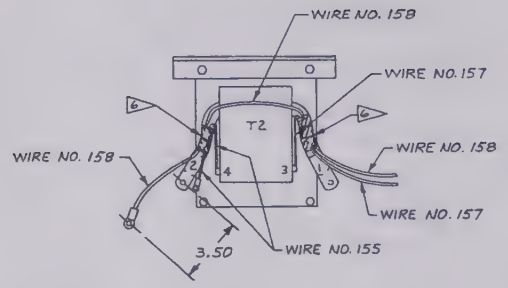




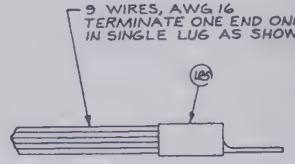
WIRE ROUTING



DETAIL D
(SEE SHEET 3)



DETAIL F
T2 CRITICAL WIRING.
WIRE NO'S SHOWN ARE FOUND ON WIRE TAB TABLE, DRAWING NO. 4100-050



DETAIL E
(REF WIRE TAB TABE DWG NO. 4100-050)
SCALE: NONE.

REVISED PER ECO	FILE NO.	PART NUMBER	PART NAME	MATERIAL – SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE

DIMS IN INCHES
TOLERANCES
XXX = .005
DO NOT SCALE DRAWING
BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES

SIZE: E

TITLE: TOP ASSEMBLY, POWER AMPLIFIER

MODEL: 150T

CONTRACT NO. 16067

DWG NO. E4150-400

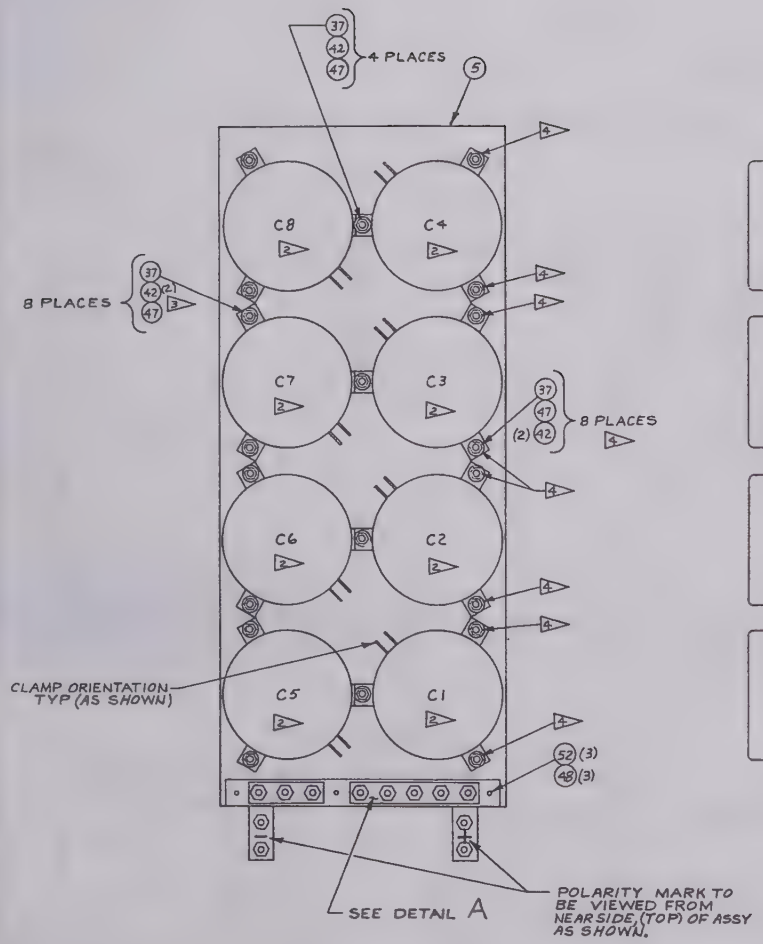
REV: B

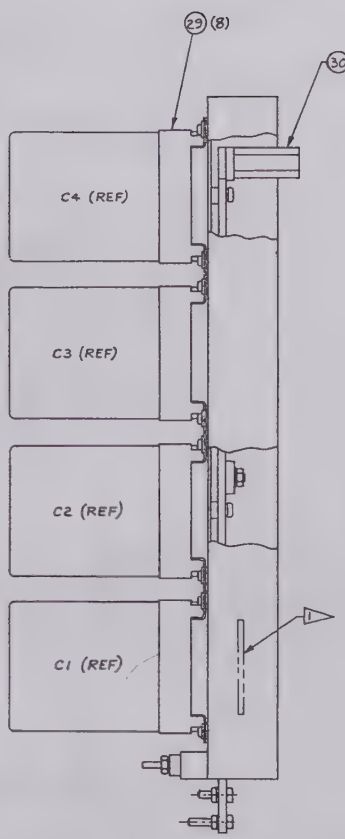
SCALE: 1/1

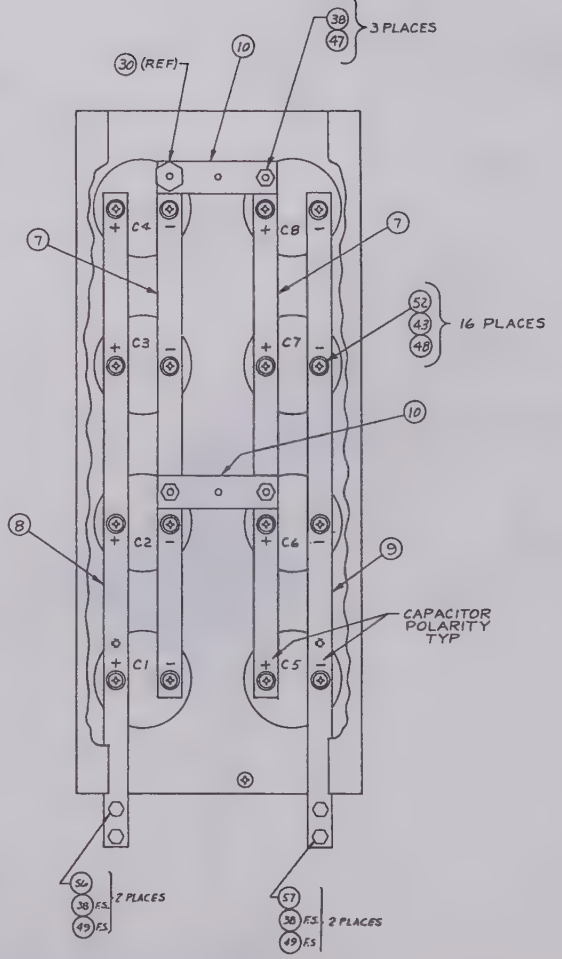
SHEET 4 OF 10

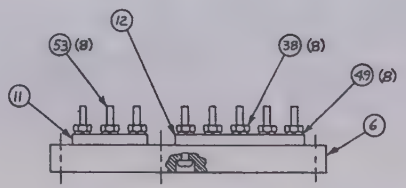
E4150-400 B

NOTES: UNLESS OTHERWISE SPECIFIED









DETAIL A

4 INSTALL C1, C2, C3 & C4 NEXT USING ONE (1) FLAT WASHER, (ITEM NO. 42), AS SPACER BETWEEN CLAMP FOOT & SURFACE OF CHASSIS ON ALL FEET FLAGGED 4

3 INSTALL C5, C6, C7 & C8 FIRST WITH CAPACITOR CLAMP BEING FLUSH WITH TOP SURFACE OF CHASSIS, (ITEM NO. 5)

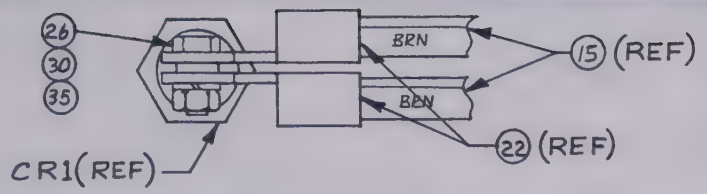
5 ALL CAPACITOR CANS TO BE INSTALLED FLUSH WITH TOP SURFACE OF CHASSIS, (ITEM NO. 5)

FOR PARTS LIST SEE SHEET 3 & ON

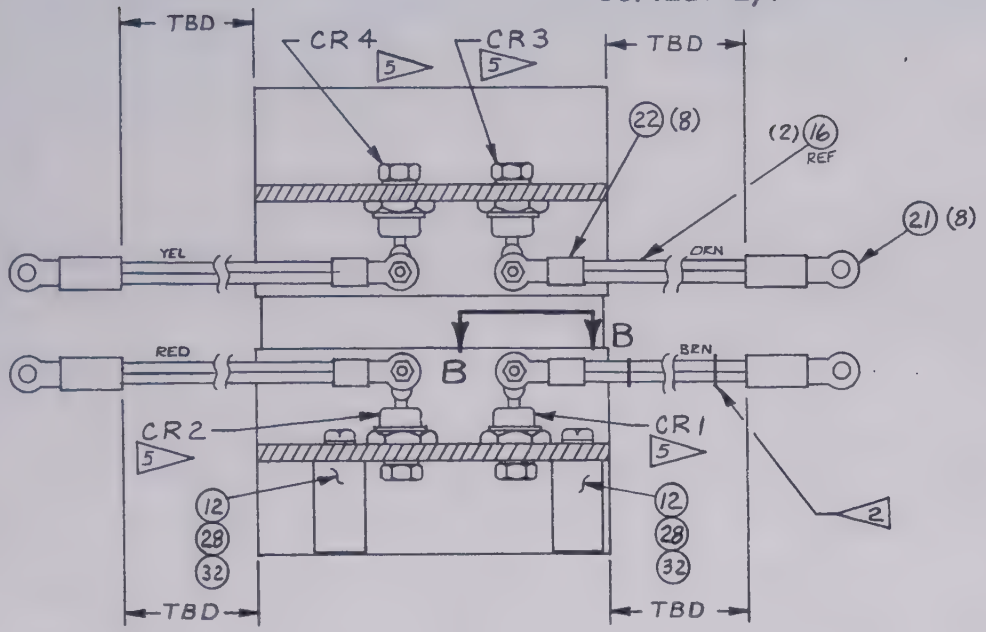
FILTER ASSY A8

E4100-4-01 | 4

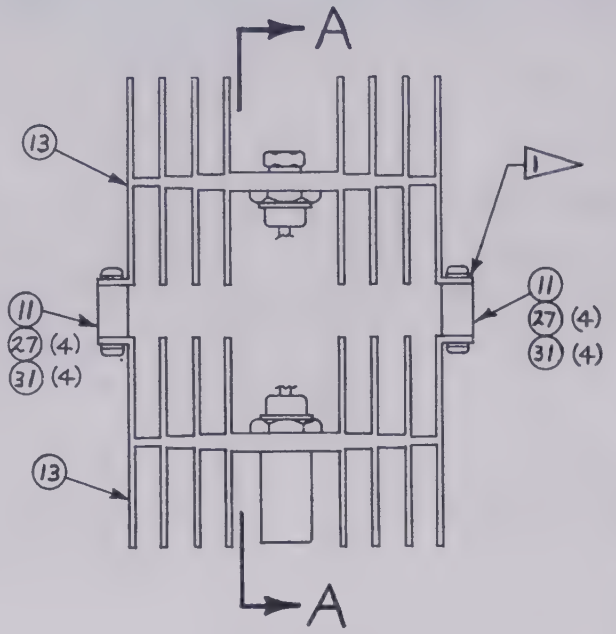
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD



SECTION B-B
(TYP 4 PLACES)
SCALE: 2/1



SECTION A-A



-1 ASSY

5 APPLY ITEM 18 (THERMATE SILICONE COMPOUND). BETWEEN DIODES & HEATSINK.

4. FOR SCHEMATIC SEE DWG E4150-070.

2 COMMON WIRES TO BE LACED TOGETHER.

1 METAL STAMP ASSY PART NO. ON TOP SIDE OF FLANGE AS SHOWN.

NOTES: (UNLESS OTHERWISE SPECIFIED)

FOR PARTS LIST, SEE SHEET 3

ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
REQD PER ASSY							

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH
-1	1	E4150-400-1		

DIM IN INCHES
TOLERANCES
XXX = .010
XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
"MACH SURFACES" ✓

DWG SIZE C

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TITLE
HEATSINK ASSY,
RECTIFIER DIODE A7

MODEL 1501T

RELEASE	M. Marca	2/3/72
CHECKER		2/1/72
DESIGN		PURCHASING
DRFTSMN		PROJ ENGR
		CHF ENGR

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CONTRACT NO.

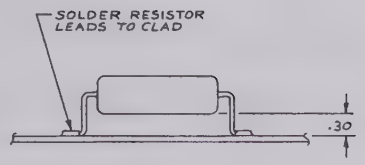
CODE IDENT 16067

DWG NO. C4150-401 REV B

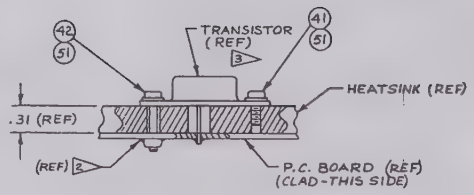
SCALE 1/1 SHEET 2 OF 3

CALICO F-388

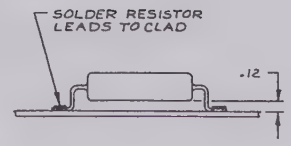
C4150-401 B



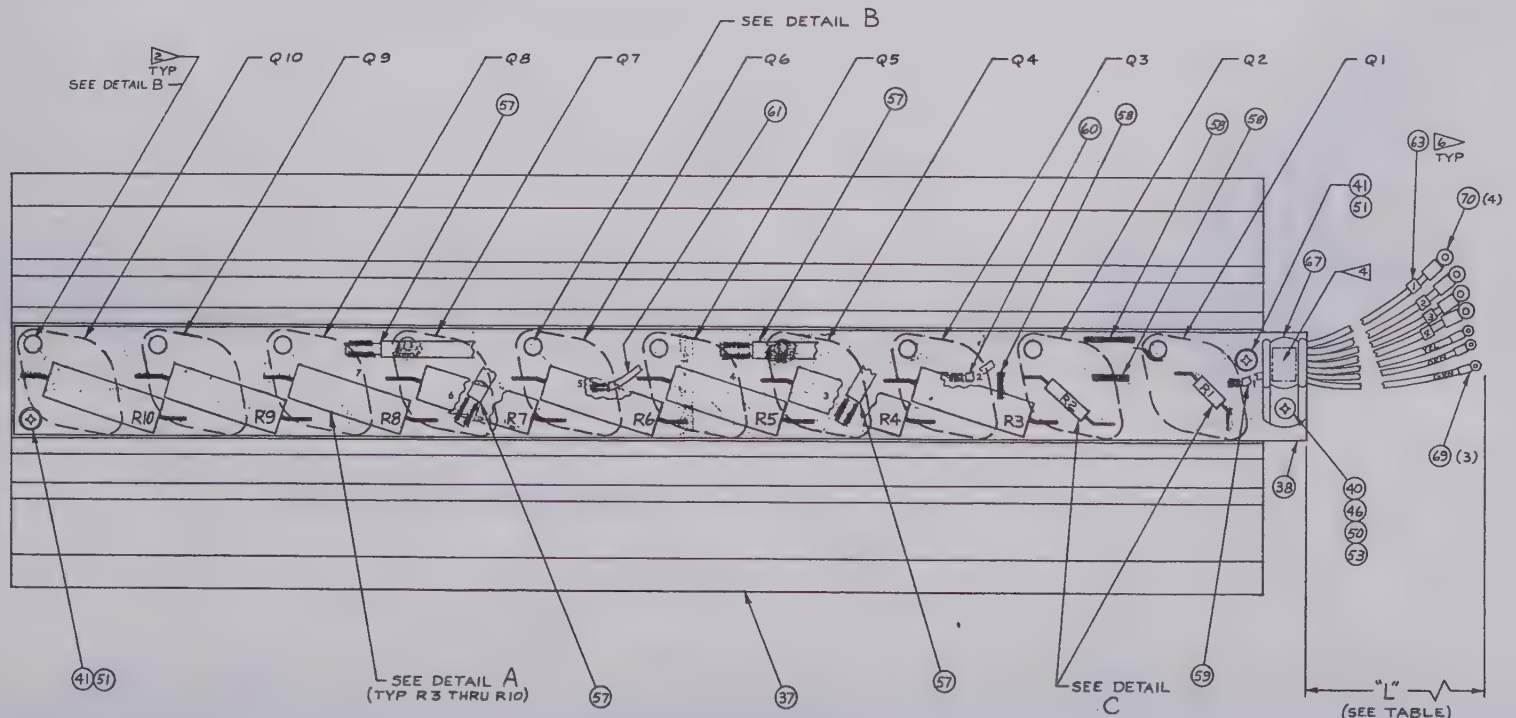
DETAIL A
(TYP R3 THRU R10)

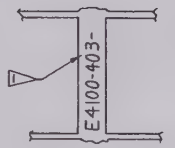


DETAIL B
(TYP TRANSISTOR MOUNTING)



DETAIL C
(TYP FOR R1 & R2)





END VIEW OF HEATSINK
(FOR IDENT LOCATION)

WIRE TAB TABLE

WIRE NO OR COLOR	FROM PAD NO.	WIRE GAUGE AND COLOR	ITEM NO.	"L" (LENGTH IN INCHES)
YEL	1	AWG 18 - YEL	59	5.5
ORN	2	AWG 18 - ORN	60	5.5
3	3	AWG 10 - WHT	57	8.0
1	4	AWG 10 - WHT	57	8.0
GRN	5	AWG 18 - GRN	61	5.5
4	6	AWG 10 - WHT	57	8.0
2	7	AWG 10 - WHT	57	8.0

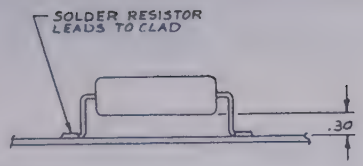
6. IDENTIFY WIRES 1 THRU 4. COORDINATE WITH WIRE TAB TABLE.
5. FOR SCHEMATIC SEE DRAWING NO. E4100-070(FOR-1) & E4150-070 (FOR-2)
4. ASSEMBLY REF DES, "A2", TO BE MARKED ON FARSIDE OF ITEM 32 IN AREA SHOWN, USING WHITE INK.
3. APPLY ITEM 65 BETWEEN TRANSISTORS & HEATSINK.
2. SOLDER CLINCH NUT TO CLAD. (TYP 10 PLACES)
1. METAL STAMP ASSY PART NO. APPROX AS SHOWN

FOR PARTS LIST - SEE SHEETS 3 & ON

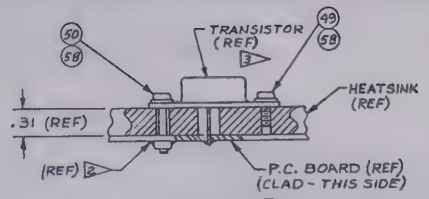
ITEM NO	PART NUMBER	PART NAME	MATERIAL SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE
REQD PER ASSY							

UNLESS OTHERWISE SPECIFIED DIMS ARE IN INCHES. TOLERANCES: .XXX ±.010, .XX ±.02, .X ±.1, ANGLES ±1°. BREAK ALL SHARP CORNERS & EDGES. MACH SURFACES √. DWG SIZE E. SCALE: 1/1. TITLE: HEATSINK ASSY, DRIVER. A2. MODEL 100L-1, 120L-1, 150L-1. SHEET 1 OF 4.

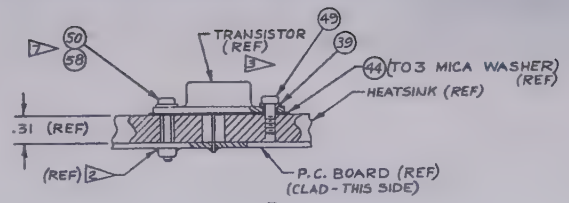
E4100-403 D



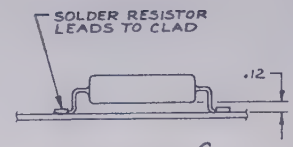
DETAIL A
(TYP R3 THRU R10)



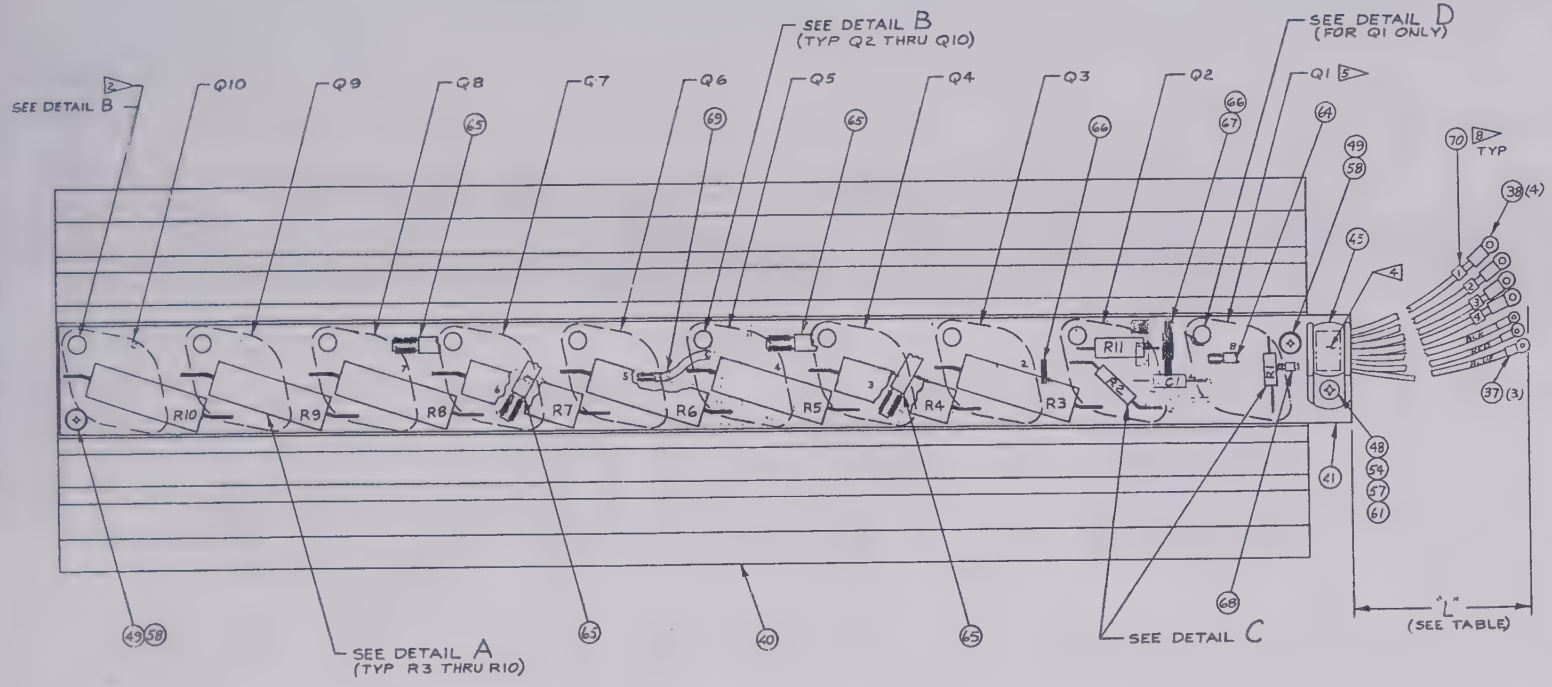
DETAIL B
(TYP Q2 THRU Q10)

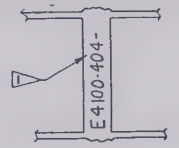


DETAIL D
(FOR Q1 ONLY)



DETAIL C
(TYP FOR R1 & R2)





END VIEW OF HEATSINK
(FOR IDENT LOCATION)

8. IDENTIFY WIRES 1 THRU 4. COORDINATE WITH WIRE TAB TABLE.
7. ITEM 50 TO BE INSULATED FROM HEATSINK, USING TEFLON SLEEVING. (FOR Q1 ONLY)
6. FOR SCHEMATIC SEE DRAWING NO. E4100-070 (FOR -1) (E4150-070 (FOR -2)
5. Q1 MUST BE INSULATED FROM HEATSINK PER DETAIL D.
4. ASSEMBLY REF DES "A4" TO BE MARKED ON FARSIDE OF ITEM 32 IN AREA SHOWN, USING WHITE INK.
3. APPLY ITEM 43 BETWEEN TRANSISTORS & HEATSINK
2. SOLDER CLINCH NUT TO CLAD (TYP 10 PLACES)
1. METAL STAMP ASSY PART NO. APPROX. AS SHOWN.

WIRE TAB TABLE

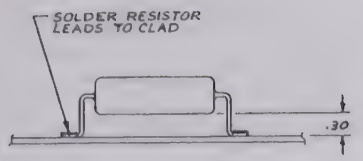
WIRE NO. OR COLOR	FROM PAD NO.	WIRE GAUGE AND COLOR	ITEM NO.	"L" (LENGTH IN INCHES)
BLK	1	AWG 18 - BLK	68	5.5
3	3	AWG 10 - WHT	65	8.0
1	4	AWG 10 - WHT	65	8.0
RED	5	AWG 18 - RED	69	5.5
4	6	AWG 10 - WHT	65	8.0
2	7	AWG 10 - WHT	65	8.0
BLUE	8	AWG 18 - BLU	64	5.5

FOR PARTS LIST - SEE SHEETS 3 & ON

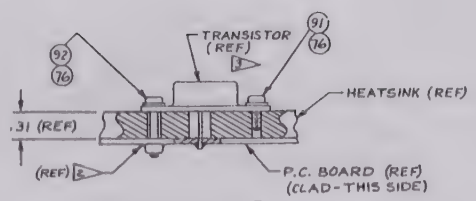
ITEM NO.	PART NUMBER	PART NAME	MATERIAL SPECIFICATION	CODE IDENT NO.	FINISH	REF DES	ZONE
-2	1	E4150-400-1					
-1	1	E4100-400-1					

TITLE: HEATSINK ASSY, DRIVER
SIZE: A4
MODEL: 1001-T ; 1201-T ; 1501-T
DWG NO: E4100-404
REV: D
SCALE: 2/1
SHEET 2 OF 5

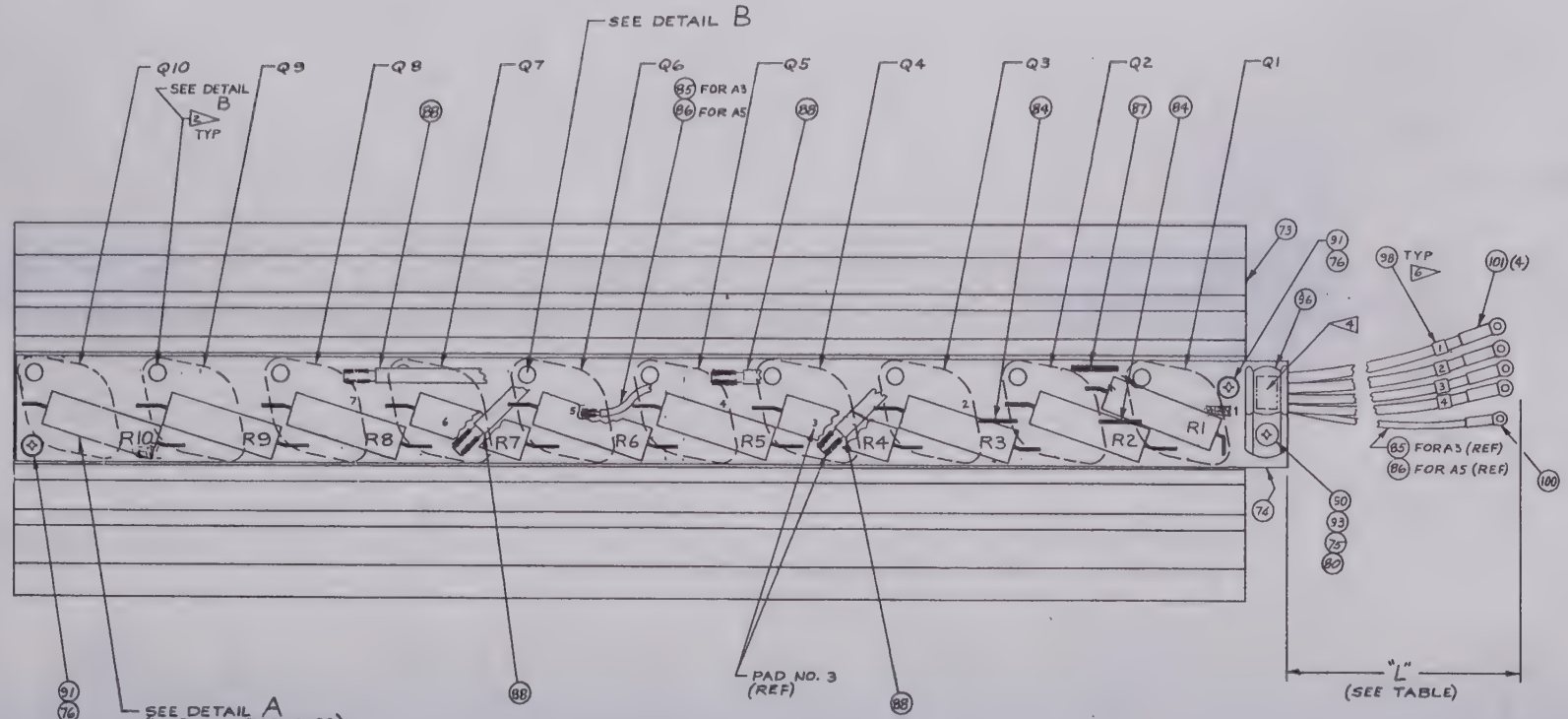
E4100-404 D

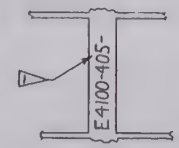


DETAIL A
(TYP RESISTOR MOUNTING)



DETAIL B
(TYP TRANSISTOR MOUNTING)





END VIEW OF HEATSINK
(FOR IDENT LOCATION)

-1 ASSEMBLY A3 (+26.5V)
-2 ASSEMBLY A5 (-26.5V)
-3 ASSEMBLY A3 (+26V)
-3 ASSEMBLY A5 (-26V)

WIRE TAB TABLE

WIRE NO. OR COLOR	FROM PAD NO.	WIRE GAUGE AND COLOR	ITEM NO.	FOR ASSY	"L" (LENGTH IN INCHES)
3	3	AWG 10-WHT	88	-1 & -3,	A3 8.0
3	3	AWG 10-WHT	88	-2 & -3,	A5 8.0
1	4	AWG 10-WHT	88	-1 & -3,	A3 8.0
1	4	AWG 10-WHT	88	-2 & -3,	A5 8.0
GRN	5	AWG 18-GRN	85	-1 & -3,	A3 5.5
RED	5	AWG 18-RED	86	-2 & -3,	A5 5.5
4	6	AWG 10-WHT	88	-1 & -3,	A3 8.0
4	6	AWG 10-WHT	88	-2 & -3,	A5 8.0
2	7	AWG 10-WHT	88	-1 & -3,	A3 8.0

6 IDENTIFY WIRES 1 THRU 4. COORDINATE WITH WIRE TAB TABLE

5 FOR SCHEMATIC SEE DRAWING NO. E4100-070 (FOR -1 & -2) & E4150-070 (FOR -3)

4 ASSEMBLY REF DES TO BE MARKED, IN WHITE INK, ON FARSIDE OF ITEM 59 IN AREA SHOWN. (REF DES ARE "A3" OR "A5")

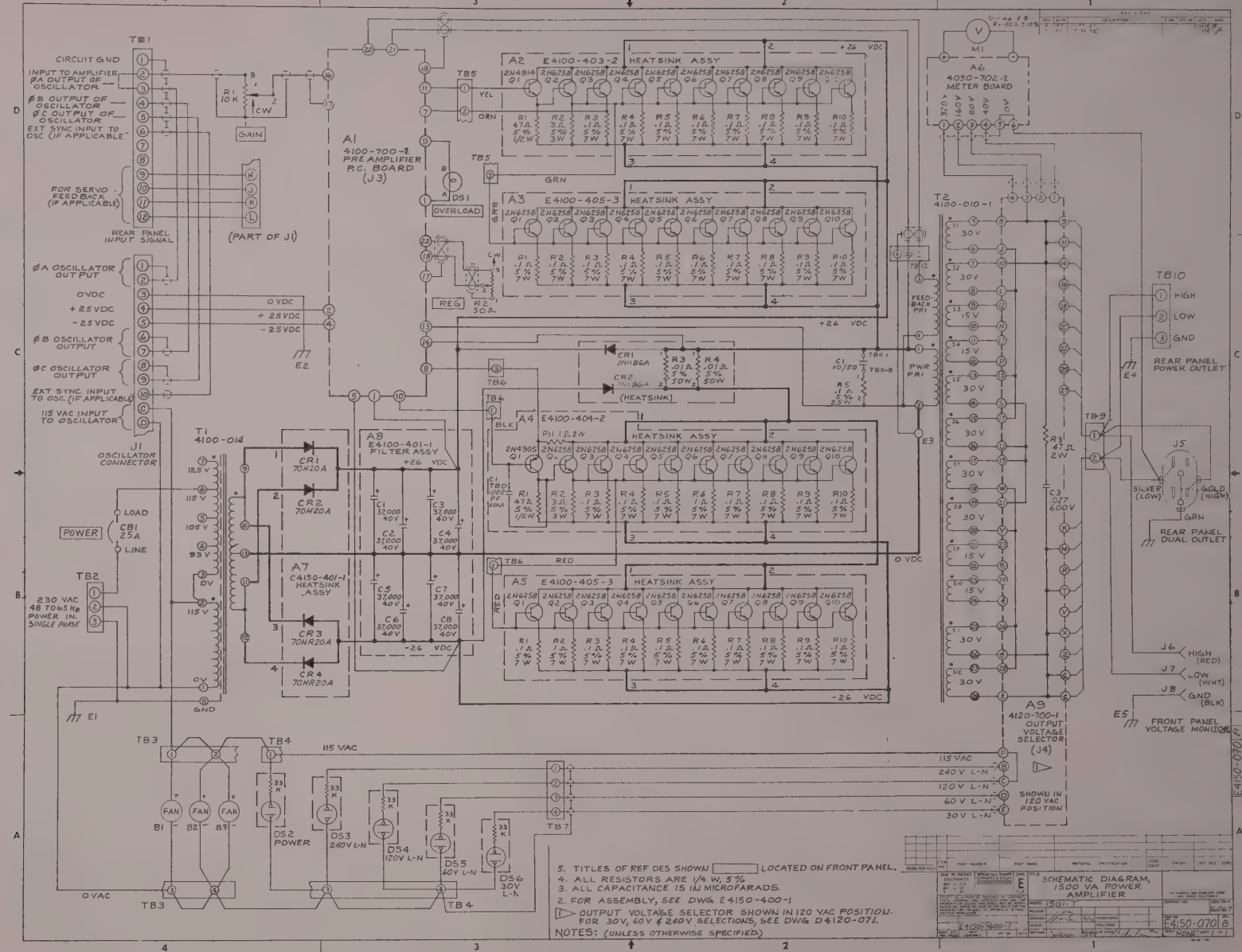
3 APPLY ITEM 97 BETWEEN TRANSISTORS AND HEATSINK

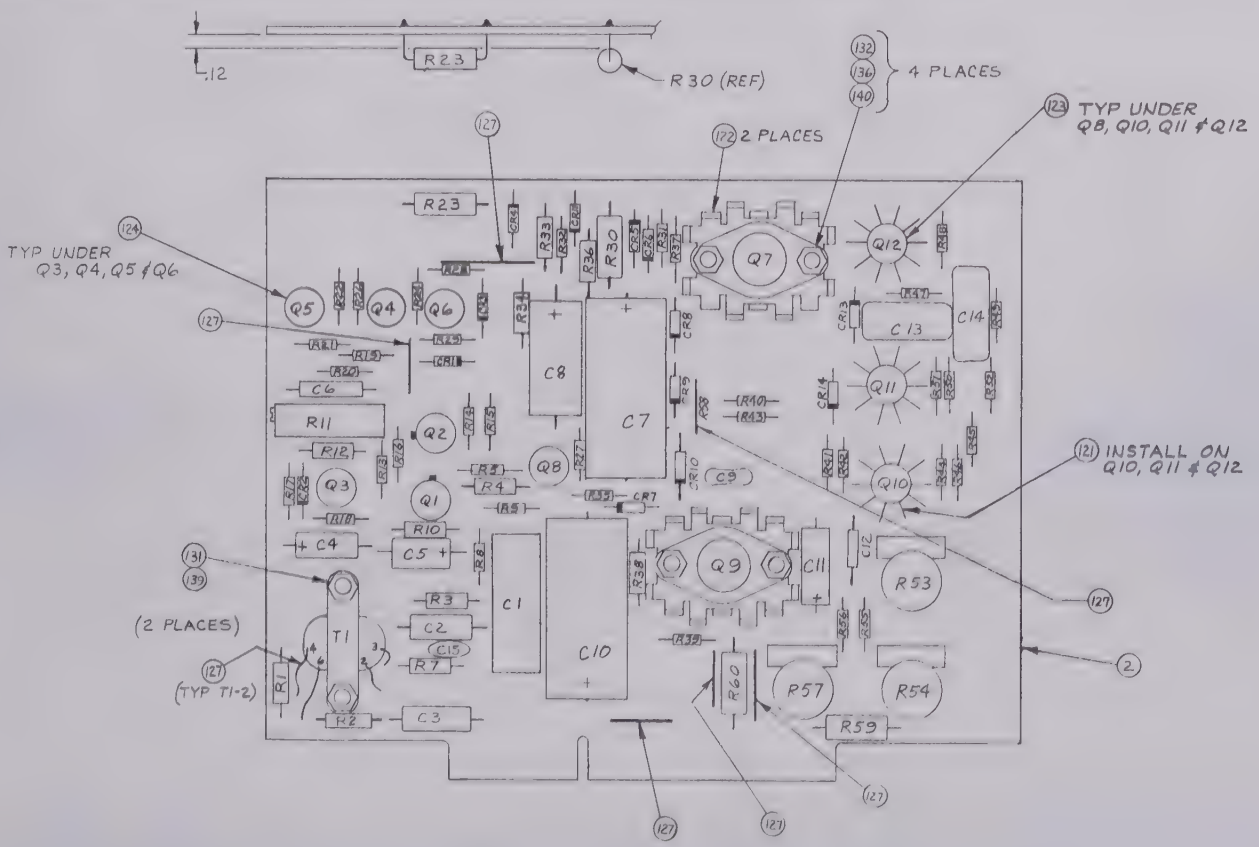
2 SOLDER CLINCH NUT TO CLAD. (TYP 10 PLACES)

FOR PARTS LIST - SEE SHEETS 3 & ON.

HEATSINK ASSY, OUTPUT POWER A3 A5

E4100-405 D


TB1
CIRCUIT GND
INPUT TO AMPLIFIER
ØA OUTPUT OF OSCILLATOR
ØB OUTPUT OF OSCILLATOR
ØC OUTPUT OF OSCILLATOR
EXT SYNC INPUT TO OSC (IF APPLICABLE
FOR SERVO FEEDBACK (IF APPLICABLE)
REAR PANEL INPUT SIGNAL
(PART OF J1)
ØA OSCILLATOR OUTPUT
0VDC
+25VDC
-25VDC
ØB OSCILLATOR OUTPUT
ØC OSCILLATOR OUTPUT
EXT SYNC. INPUT TO OSC. (IF APPLICABLE)
115 VAC INPUT TO OSCILLATOR
J1
OSCILLATOR CONNECTOR
R1 10K CW
GAIN
A1
4100-700-2
PRE AMPLIFIER P.C. BOARD (J3)
DS1
OVERLOAD
R2 50Ω
REG
E2
T1
4100-014
CR1 70H20A
CR2 70H20A
CR3 70HR20A
CR4 70HR20A
A8
E4100-401-1
FILTER ASSY
+26 VDC
C1 37,000 40V
C2 37,000 40V
C3 37,000 40V
C4 37,000 40V
A7
C4150-401-1
HEATSINK ASSY
C5 37,000 40V
C6 37,000 40V
C7 37,000 40V
C8 37,000 40V
-26 VDC
POWER
CB1 25A
LOAD
LINE
TB2
230 VAC 48 TO 65 Hz POWER IN, SINGLE PHASE
115 V
105 V
93 V
0V
GND
E1
TB3
TB4
115 VAC
FAN B1
FAN B2
FAN B3
DS2 POWER
DS3 240V L-N
DS4 120V L-N
DS5 60V L-N
DS6 30V L-N
0VAC
TB5
YEL
ORN
GRN
TB6
BLK
RED
A2 E4100-403-2 HEATSINK ASSY
A3 E4100-405-3 HEATSINK ASSY
A4 E4100-404-2 HEATSINK ASSY
A5 E4100-405-3 HEATSINK ASSY
2N4914 Q1
2N6258 Q2-Q10
2N4905 Q1
R1 47Ω 5% 1/2W
R2 3Ω 5% 3W
R3-R10 .1Ω 5% 7W
+26 VDC
0 VDC
-26 VDC
CR1 IN1186A
CR2 IN1186A
R3 .01Ω 5% 50W
R4 .01Ω 5% 50W
R5 .1Ω 5% 25W
C1 10/50
C1 1000 PF 1000 VDCW
PII 1.2N
A6
4050-702-2
METER BOARD
M1
T2
4100-010-1
PWR PRI
FEEDBACK PRI
30 V
15 V
R3 47Ω 2W
C3 .22 600V
A9
4120-700-1
OUTPUT VOLTAGE SELECTOR (J4)
115 VAC
240 V L-N
120 V L-N
60 V L-N
30 V L-N
SHOWN IN 120 VAC POSITION
TB10
HIGH
LOW
GND
REAR PANEL POWER OUTLET
E4
TB9
J5
SILVER (LOW)
GOLD (HIGH)
GRN
REAR PANEL DUAL OUTLET
J6 HIGH (RED)
J7 LOW (WHT)
J8 GND (BLK)
E5
FRONT PANEL VOLTAGE MONITOR
5. TITLES OF REF DES SHOWN [ ] LOCATED ON FRONT PANEL.
4. ALL RESISTORS ARE 1/4 W, 5%
3. ALL CAPACITANCE IS IN MICROFARADS.
2. FOR ASSEMBLY, SEE DWG. E4150-400-1
OUTPUT VOLTAGE SELECTOR SHOWN IN 120 VAC POSITION. FOR 30V, 60V & 240V SELECTIONS, SEE DWG. D4120-071.
NOTES: (UNLESS OTHERWISE SPECIFIED)
SCHEMATIC DIAGRAM, 1500 VA POWER AMPLIFIER
MODEL 1501-1
E4150-400-1
E4150-070
NONE



-1 P.C. BOARD ASSY

2 REF DES R6, R25, & CR12 NOT USED
1. FOR SCHEMATIC SEE DWG NO. D4100-071.

NOTES: (UNLESS OTHERWISE SPECIFIED)

FOR PARTS LIST SEE SHEET 4 & ON.

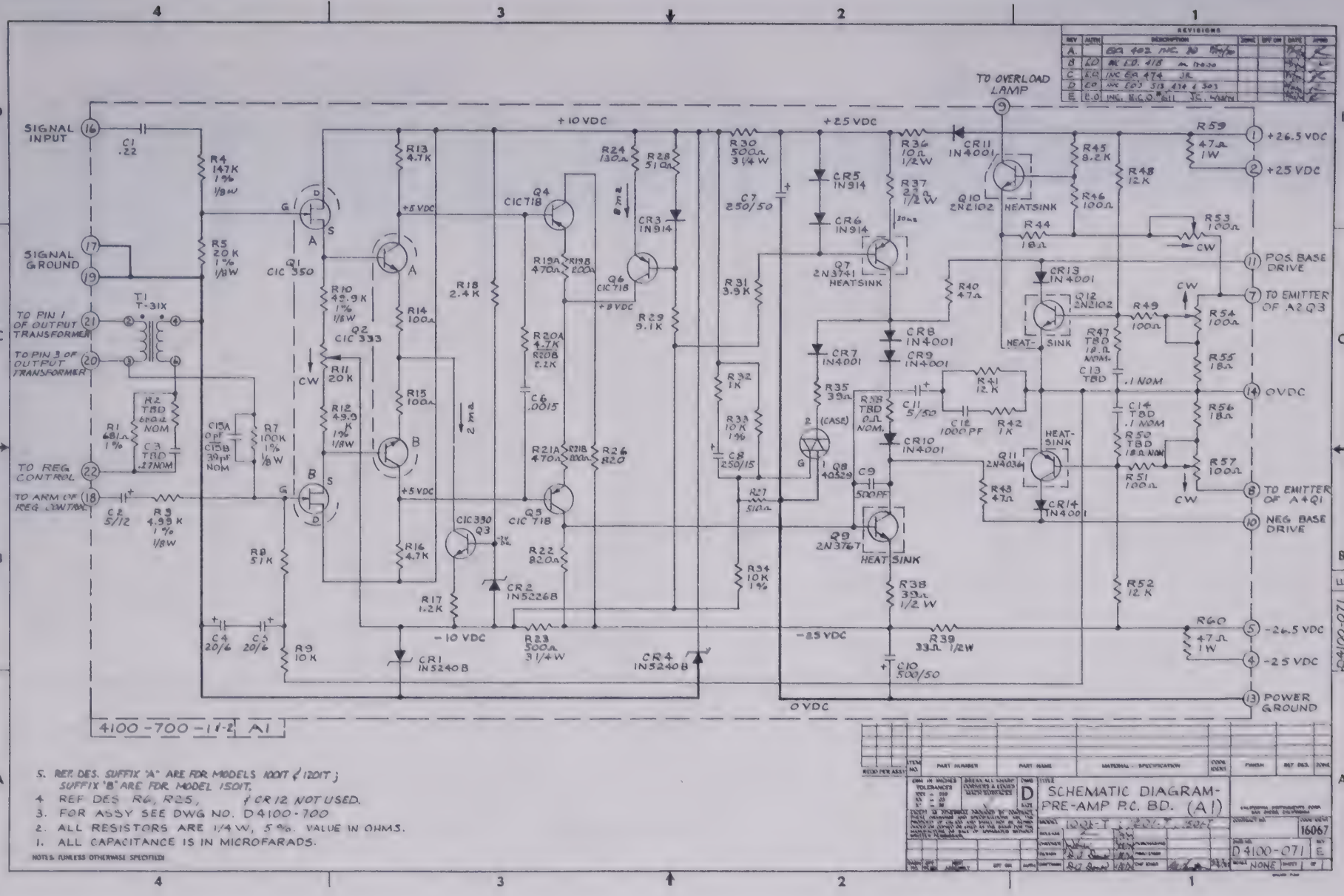
ITEM NO	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES	NOTES

P.C. BOARD ASSY, PREAMPLIFIER A1

D4100-700 F

SCALE 2/1 SHEET 2 OF 7

D4100-700 F



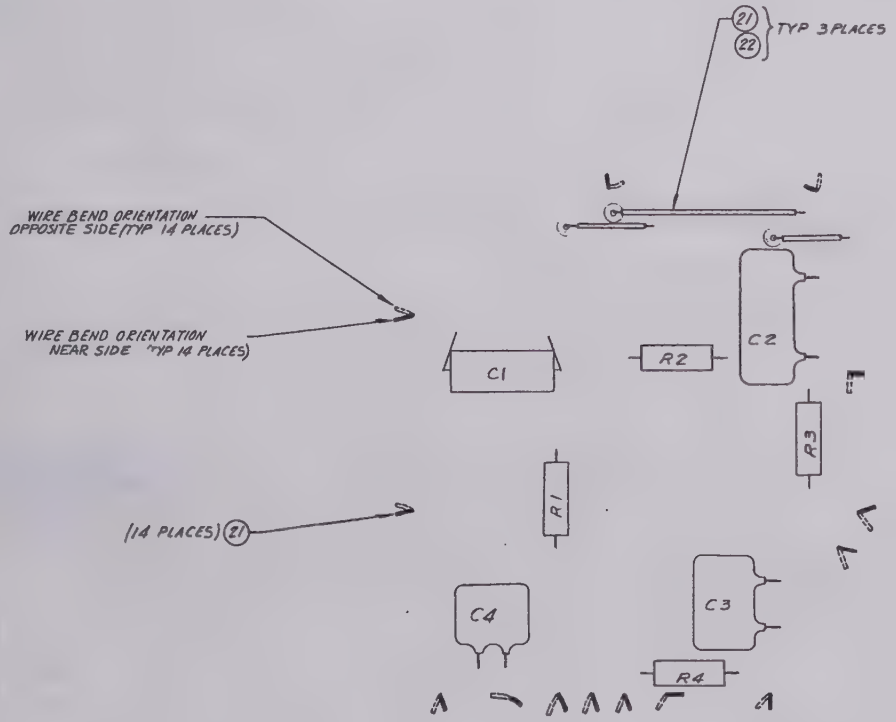
5. REF. DES. SUFFIX 'A' ARE FOR MODELS 1001T & 1201T; SUFFIX 'B' ARE FOR MODEL 1501T.
4. REF DES R6, R25, & CR12 NOT USED.
3. FOR ASSY SEE DWG NO. D4100-700
2. ALL RESISTORS ARE 1/4 W, 5%. VALUE IN OHMS.
1. ALL CAPACITANCE IS IN MICROFARADS.

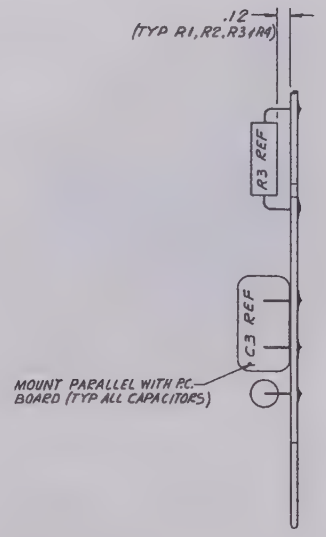
NOTES: (UNLESS OTHERWISE SPECIFIED)

REVISIONS					
REV	AUTH	DESCRIPTION	ZONE	SPT OR	DATE
A		ECR 402 INC. A2			
B	LD	INC E.O. 418 & 1430			
C	EO	INC ECR 474			
D	EO	INC EO'S 513, 434 & 503			
E	E.O.	INC. E.C.O. 811			

D SCHEMATIC DIAGRAM-PRE-AMP P.C. BD. (A1)

D4100-071 E





REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	E/T OR	DATE	APRD

2 INSERT ITEM 21 & BEND EACH SIDE IN DIRECTION OF CLAD, AS SHOWN AT ORIENTATION CALLOUT. SOLDER BOTH SIDES.

1. FOR SCHEMATIC SEE DWG. No. D4120-071 OR D4090-071

NOTES: (UNLESS OTHERWISE SPECIFIED)

PL 4120-700 PARTS LIST SHEET 4

REQD PER ASSY	ITEM NO	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

DIM IN INCHES
TOLERANCES
.XXX = .010
.XX = .03
X° = 30
BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES ✓

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DWG SIZE D

TITLE: SELECTOR CARD ASSEMBLY

MODEL 1201T / 901T / 1501T

RELEASE

CHECKED

DESIGN

DRAFTSMAN

PURCHASING

PROJ ENGR

QUAL ENGR

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

CONTRACT NO.

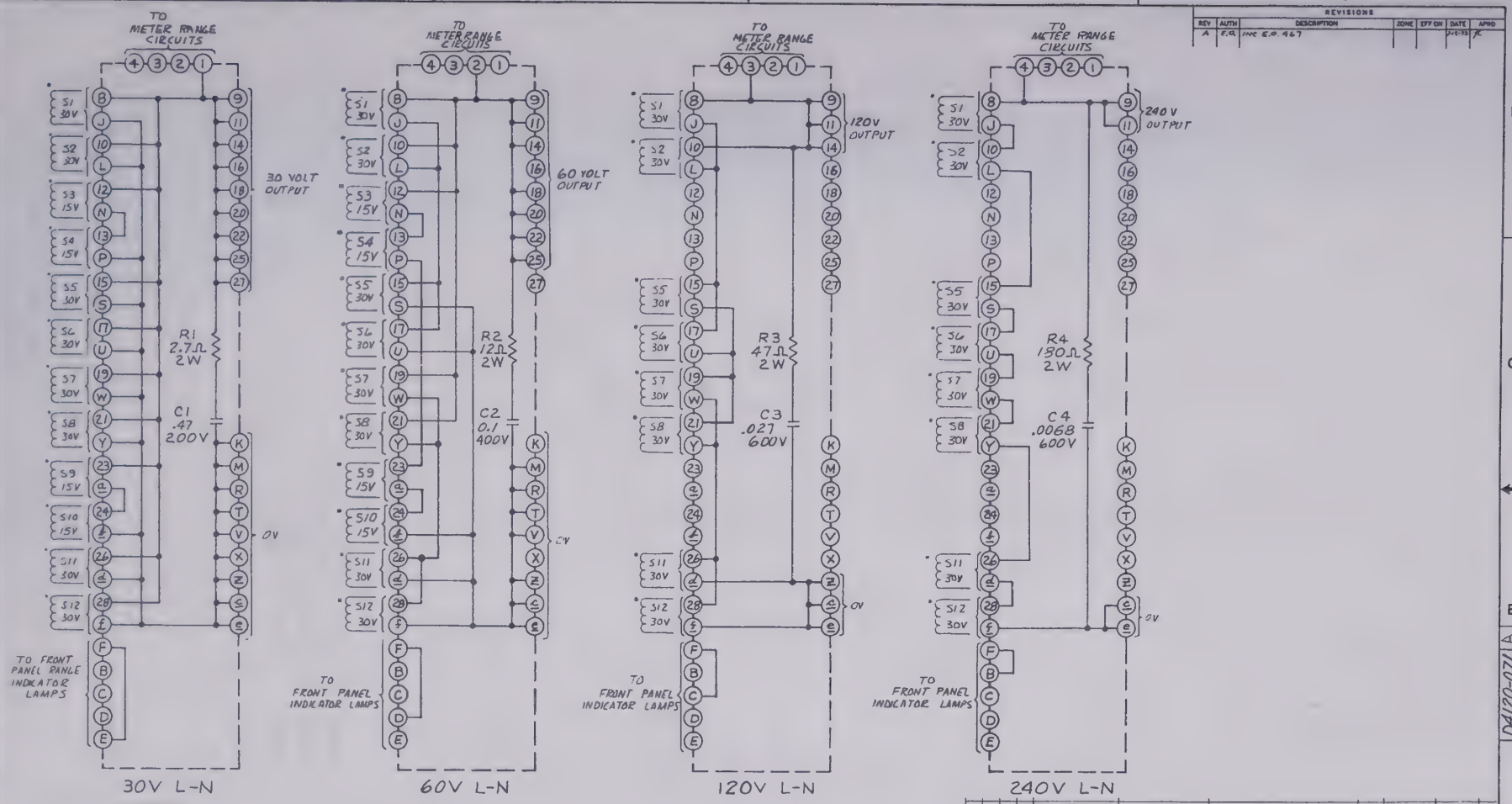
CODE IDENT 16067

DWG NO. D4120-700 REV C

SCALE 2/1 SHEET 2 of 4

DASH NO. | QTY REQD | NEXT ASSEMBLY | E/T OR | AUTH

D4120-700 C



REVISIONS					
REV	AUTH	DESCRIPTION	ZONE	ECN OR	DATE / APRD
A	E.O.	INC E.O. 967			7-6-73

D4120-071 A

ITEM NO	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE
REQD PER ASSY							

DIM IN INCHES TOLERANCES XXX ± .010, XX ± .03, X° ± 30'. BREAK ALL SHARP CORNERS & EDGES. MACH SURFACES √. EXCEPT AS OTHERWISE PROVIDED BY CONTRACT THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALRAD AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION. DWG SIZE D.

TITLE: SCHEMATIC DIAGRAM, OUTPUT VOLTAGE SELECTOR PRINTED CIRCUIT BOARD

MODEL 1201T / 1501T

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

CONTRACT NO. | CODE IDENT 16067

DWG NO. D4120-071 | REV A

SCALE NONE | SHEET 1 OF 1

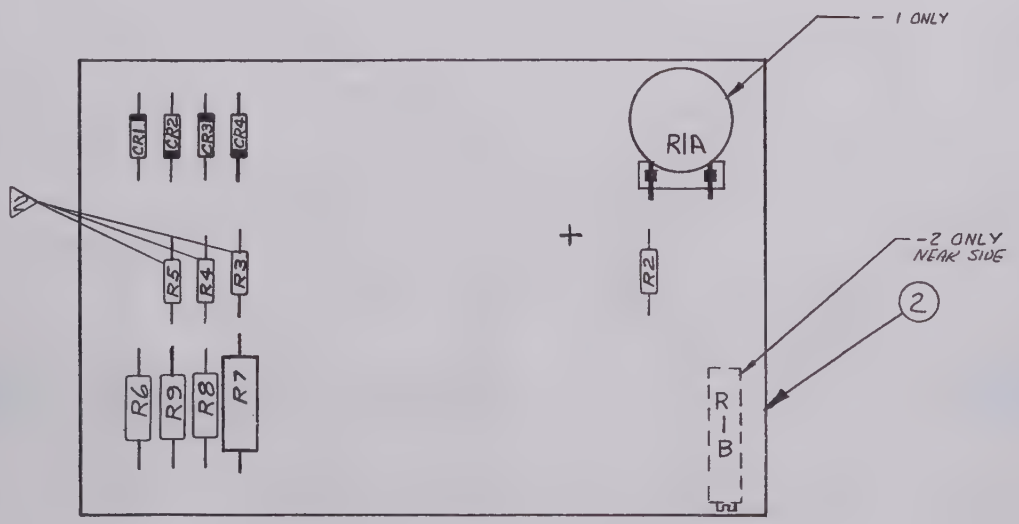
RELEASE | CHECKED | DESIGN | DRAFTSMAN | PURCHASING | PROJ ENGR | CHF ENGR

DASH NO | QTY REQD | NEXT ASSEMBLY | ITF ON | AUTH

2. CORRELATE WITH UNIT SCHEMATIC NO. E4120-070 (FOR 1201T) OR E4150-070 (FOR 1501T)
1. FOR P.C. BOARD, SEE DWG. NO. 4120-700

NOTES: (UNLESS OTHERWISE SPECIFIED)

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD



A6

-1 ASSEMBLY

VIEWED FROM COMPONENT SIDE

C4050-70. C

PL 4050-702 PARTS LIST ON SHEET 4

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
-1								

DIM IN INCHES TOLERANCES .XXX = .010 .XX = .03 X° = 30'

BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓

DWG SIZE C

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO. AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

TITLE: VOLTMETER P.C. BOARD ASSY

MODEL: ALL A.C. POWER SOURCES (A6)

RELEASE	-		PURCHASING
CHECKER	J Wiener	7/15/69	PROJ ENGR
DESIGN			CHF ENGR
DRFTSMN	D. Danes	7/7/69	

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

CONTRACT NO. | CODE IDENT 16067

DWG NO. C 4050-702 | REV C

SCALE 2/1 | SHEET 2 OF 4

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

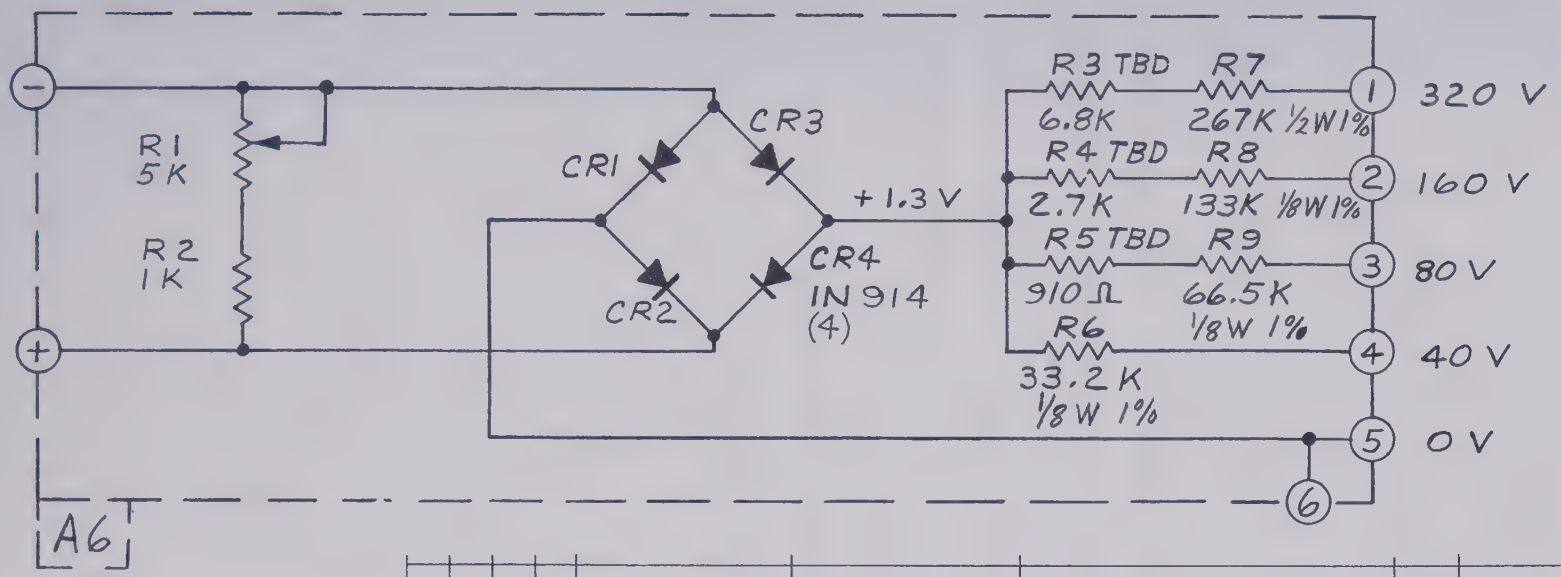
<2> MOUNT R3, R4, & R5 FAR SIDE.

1. FOR SCHEMATIC SEE DWG NO. B 4050-072

NOTES: (UNLESS OTHERWISE SPECIFIED)

B4050-072 A

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
A		ADDED EYELET NO.6 Danes			12/16/9	



REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

3. PREFIX "A6" TO BE USED WITH ALL REF DES. (EXAMPLE: A6R1)
2. FOR ASSY SEE D4050-702
1. ALL RESISTORS ARE ¼W 5%

NOTES: (UNLESS OTHERWISE SPECIFIED)

DIM IN INCHES
TOLERANCES
.XXX = .010
.XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES ✓

DWG SIZE B

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

TITLE
SCHEMATIC DIAGRAM VOLTMETER P.C. BD.

MODEL ALL "T" SERIES AC INVERTRONS

RELEASE	[illegible]	11/7/69			
CHECKER	[illegible]	7/15/9	PURCHASING		
DESIGN			PROJ ENGR		
DRFTSMN	D. Danes	5/6/9	CHF ENGR		

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CONTRACT NO.

CODE IDENT 16067

DWG NO. B4050-072 REV A

SCALE NONE SHEET 1 OF 1

CALICO F-101

7.1 GENERAL

This section contains ordering information and complete list of replaceable parts. Parts are listed by major assembly in alphanumerical order of their reference designators. Description, manufacturer's part number, manufacturer's code ident number (see Appendix A or list of manufacturer's), and CALIFORNIA INSTRUMENTS stock numbers are indicated.

7.2 ORDERING INFORMATION

In order to provide our customers with prompt service on replacement parts, please provide the following information, when applicable, for each part ordered:

a) Model number and serial number of the instrument,

b) CALIFORNIA INSTRUMENTS part number of the sub-assembly where component is located,

c) Component reference designator,

d) Component description,

e) Component manufacturer's number and code ident,

f) CALIFORNIA INSTRUMENTS stock number,

All replacement parts orders should be placed with CALIFORNIA INSTRUMENTS COMPANY, a division of Aiken Industries, San Diego, California, 92111.

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	E4150-400-1	POWER AMPLIFIER	16067		1
					2
					3
					4
A1	D4100-700-2	PRE-AMP P.C. BOARD ASSY	16067		5
A2	E4100-403-2	HEATSINK ASSY. +26V	16067		6
A3	E4100-405-3	HEATSINK ASSY. +26V	16067		7
A4	E4100-404-2	HEATSINK ASSY. -26V	16067		8
A5	E4100-405-3	HEATSINK ASSY. -26V	16067		9
A6	C4050-702-2	METER BOARD ASSY	16067		10
A7	C4150-401-1	HEATSINK ASSY. Rectifier	16067		11
A8	E4100-401-1	FILTER ASSY.	16067		12
A9	4120-700-1	SELECTOR CARD ASSY.	16067		13
					14
					15
B1	7500	FAN (265 CFM)	23936	2-10055	16
B2	4500	FAN (115 CFM)	23936	2-41063	17
B3	7500	FAN (265 CFM)	23936	2-10055	18
					19
					20
C1	625B1B106M*	CAPACITOR, 10/100V	14752	6-10853	21
	* TESTED TO 12 V RMS AT 10 KHz				22
					23
CB1	AM12-25-250-5-60	CIRCUIT BREAKER	74193	2-70014	24
		(250V, 60 Hz, Curve 5)			25
					26
					27
CR1	1N1186A	DIODE	95303	3-10167	28
CR2	1N1186A	DIODE	95303	3-10167	29
					30
					31
DS1	CF03-RCS-2174	LAMP	03797	2-50063	32
DS2	BG03-ACS-NE2H/33K	LIGHT	03797	2-41021	33
DS3	BG03-RCS-NE2H/33K	LIGHT	03797	2-41022	34
DS4	BG03-RCS-NE2H/33K	LIGHT	03797	2-41022	35
DS5	BG03-RCS-NE2H/33K	LIGHT	03797	2-41022	36

MODEL 1501T

CALICO P/N 4150-400 B

ASSY R.D.

TITLE TOP ASSEMBLY, 1500VA POWER AMPLIFIER

SHT 5 OF 10

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
DS6	BG03-RCS-NE2H/33K	LIGHT	03797	2-41022	37
					38
					39
					40
J1	8BD10S-0	CONNECTOR	81312	4-10032	41
J2		NOT USED			42
J3	8BD22S-15	CONNECTOR	81312	4-10151	43
J4	8BD28S-7	CONNECTOR	81312	4-10145	44
J5	5362	RECEPTACLE	74545	2-41111	45
J6	DF-31-RC	BINDING POST (RED)	58474	2-40041	46
J7	DF-31-WTC	BINDING POST (WHITE)	58474	2-40090	47
J8	DF-31-BC	BINDING POST (BLACK)	58474	2-40040	48
					49
					50
M1	CIC 800-2	VOLTMETER	16067	2-41116	51
					52
					53
R1	B4010-012-1	POTENTIOMETER 10K	16067	5-70128	54
R2	78PR50Ω	POTENTIOMETER 50Ω	73138	5-75052	55
R3	RH50-73 .01Ω	RESISTOR .01Ω 5% 50W	91637	5-50189	56
R4	RH50-73 .01Ω	RESISTOR .01Ω 5% 50W	91637	5-50189	57
R5	RH25 .1Ω 5%	RESISTOR .1Ω 5% 25W	91637	5-50196	58
					59
					60
					61
T1	A4100-014-1	TRANSFORMER, POWER	16067	7-10235	62
T2	A4100-010-1	TRANSFORMER, OUTPUT	16067	7-10191	63
					64
					65
					66
TB1	410Y-12	TERMINAL BOARD	75382	2-41123	67
TB2	9-85-3	TERMINAL BLOCK	75382	2-40321	68
TB3	3006	TERMINAL STRIP	83330	2-40110	69
TB4	855	TERMINAL STRIP	83330	2-50071	70
TB5	599-3	TERMINAL BOARD	75382	2-50072	71
TB6	599-3	TERMINAL BOARD	75382	2-50072	72

MODEL 1501T | CALICO P/N 4150-400 | B | ASSY R.D.

TITLE TOP ASSEMBLY, 1500VA POWER AMPLIFIER | SHT 6 OF 10

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
B7	855	TERMINAL STRIP	83330	2-50071	73
B8		TERMINAL BLOCK on Filter Assy (Ref)			74
B9	603-2	TERMINAL BOARD	75382	2-50073	75
B10	9-85-3	TERMINAL BLOCK	75382	2-40321	76
B11	3008	TERMINAL STRIP	83330	2-40109	77
B12	857	TERMINAL STRIP	83330	2-50132	78
					79
					80
	D4100-218-1	SUPPORT ASSY, COVER	16067	1-10194	81
	E4100-200-1	ENCLOSURE ASSY.	16067	1-10123	82
	D4100-201-2	PANEL ASSY., FRONT	16067	1-10344	83
	E4100-202-1	PANEL ASSY., REAR	16067	1-10125	84
	D4100-204-1	COVER ASSY., H.S.	16067	1-10127	85
	D4100-205-7	COVER, ENCLOSURE	16067	1-10128	86
	D4100-206-10	INSULATOR	16067	2-10045	87
	B4100-208-7	SUPPORT, CONNECTOR	16067	1-10135	88
	D4100-211-1	BRACKET, PLUG-IN	16067	1-10136	89
	D4100-212-7	BRACKET, SELECTOR	16067	1-10137	90
	C4100-213-1	BUSS BAR, -26V	16067	1-10138	91
	C4100-213-2	BUSS BAR, +26V	16067	1-10139	92
	C4100-214-7	COVER, SELECTOR	16067	1-10140	93
	C4100-216-7	SUPPORT, RESISTOR	16067	1-10142	94
					95
	D4025-214-7	INSULATOR, HEATSINK	16067	2-10205	96
	831	CABLE CLAMP	83330		97
	834	CABLE CLAMP	83330		98
	PS70-2-BLACK	KNOB, BLACK	21604	2-40233	99
	5504	FINGER GUARD	23936	2-41064	100
	5506	FINGER GUARD	23936	2-10074	101
	FCA-3	HANDLE	08730	2-40224	102
	Q-081-905	CLIP	03797	2-50077	103
	Q-082-2K	SOCKET	03797	2-50078	104
	322125	TERMINAL LUG, INSULATED	00779	2-50075	105
	322900	TERMINAL LUG, 90°, Insulated	00779	2-50074	106
	3241	GROMMET	08065	2-10173	107
	56BW	BUSHING MOUNT	73138	2-41067	108

MODEL 1501T

CALICO P/N 4150-400

ASSY R.D. B

TITLE TOP ASSEMBLY, 1500VA POWER AMPLIFIER

SHT 7 OF 10

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	RD9361	RING LUG, INSULATED	59730		109
	910	ADHESIVE, EASTMAN			110
	10650	LAMP RETAINER	03797	2-41025	111
	WG-301	CATERPILLAR GROMMET	75987		112
	MW-750-255	WASHER, MICA 1/4" I.D.	08298	2-10155	113
	2664	WASHER, NYLON SHOULDER	83330	2-10129	114
					115
	5005-02P	CARD GUIDE	13103	2-41124	116
	AWG2	WIRE, INSULATED, BLACK			117
	5/16 - 18 x 3/4 LG.	SCREW, CAP - HEX HEAD		2-10172	118
	5/16 - 18 x 1/2 HEX	NUT, HEX		2-10107	119
	5/16	WASHER, FLAT		2-10095	120
	5/16	WASHER, SPLIT LOCK		2-10098	121
	6-32 x 1-3/8 LG.	SCREW, PAN HEAD		2-10067	122
	4-40 x 1/2 LG.	SCREW, ROUND HD.		2-10396	123
	410J	JUMPER	75382	2-50090	124
	RE9261	RING LUG, INSULATED	59730	2-50098	125
					126
					127
					128
	4-40 - 5/16 LG.	SCREW, FLAT HEAD			129
					130
	4-40 x 3/8 LG.	SCREW, PAN HEAD			131
	4-40 x 1/2 LG.	SCREW, PAN HEAD			132
					133
					134
					135
					136
	6-32 x 1/4 LG.	SCREW, FLAT HEAD			137
	6-32 x 1/4 LG.	SCREW, PAN HEAD			138
	6-32 x 5/16 LG.	SCREW, PAN HEAD			139
	6-32 x 5/8 LG.	SCREW, FLAT HEAD			140
	6-32 x 3/8 LG.	SCREW, FLAT HEAD			141
	6-32 x 3/8 LG.	SCREW, PAN HEAD			142
	6-32 x 7/16 LG.	SCREW, FLAT HEAD			143
	6-32 x 7/16 LG.	SCREW, PAN HEAD			144

MODEL 1501T | CALICO P/N 4150-400 | B | ASSY R.D.

TITLE TOP ASSEMBLY, 1500VA POWER AMPLIFIER | SHT 8 OF 10

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	6-32 x 1/4 LG.	SCREW, FLAT HEAD			145
	6-32 x 1/2 LG.	SCREW, PAN HEAD			146
	6-32 x 3/4 LG.	SCREW, PAN HEAD			147
					148
					149
					150
	8-32 x 3/8 LG.	SCREW, PAN HEAD			151
	8-32 x 7/16 LG.	SCREW, PAN HEAD			152
	8-32 x 5/8 LG.	SCREW, PAN HEAD			153
	8-32 x 5/8 LG.	SCREW, FLAT HEAD			154
	8-32 x 3/4 LG.	SCREW, PAN HEAD			155
					156
					157
	10-32 x 7/16 LG.	SCREW, FLAT HEAD			158
					159
					160
					161
	10-32 x 1/2 LG.	SCREW, PAN HEAD			162
	10-32 x 5/8 LG.	SCREW, PAN HEAD			163
	10-32 x 1/2 LG.	SCREW, FLAT HEAD			164
	10-32 x 1/2 LG.	SCREW, HEX HEAD		2-10233	165
	10-32 x 3/8 LG.	SCREW, HEX HEAD		2-10354	166
					167
	#4	WASHER, INT. LOCK			168
					169
	#6	WASHER, INT. LOCK			170
	#6	WASHER, FLAT			171
	#8	WASHER, EXT. LOCK			172
	#8	WASHER, FLAT			173
	#10	WASHER, EXT. LOCK			174
	#10	WASHER, FLAT			175
					176
					177
					178
					179
	#10 - MED WT	WASHER, SPLIT LOCK			180

MODEL 1501T

CALICO P/N 4150-400

B

ASSY R.D.

TITLE TOP ASSEMBLY, 1500VA POWER AMPLIFIER

SHT 9 OF 10

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	4-40	NUT, HEX			181
	6-32	NUT, HEX			182
	8-32	NUT, HEX			183
	10-32	NUT, HEX			184
					185
					186
					187
					188
					189
	AWG 8	WIRE, INSULATED, WHITE			190
					191
					192
					193
					194
					195
					196
					197
					198
					199
					200
					201
					202
					203
					204
					205
					206
					207
					208
					209
					210
					211
					212
					213
					214
					215
					216

MODEL 1501T

CALICO P/N 4150-400 B

ASSY R.D.

TITLE TOP ASSEMBLY, 1500VA POWER AMPLIFIER

SHT 10 OF 10

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A8	E4100-401	FILTER ASSY	16067		1
					2
					3
					4
	D4100-203-1	SUPPORT ASSY	16067	1-10126	5
	C4100-206-7	INSULATOR	16067	2-10042	6
	D4100-207-1	BUSS BAR	16067	1-10129	7
	D4100-207-8	BUSS BAR (+)	16067	1-10130	8
	D4100-207-9	BUSS BAR (-)	16067	1-10131	9
	D4100-207-10	BUSS BAR	16067	1-10132	10
	D4100-207-11	BUSS BAR	16067	1-10133	11
	D4100-207-12	BUSS BAR	16067	1-10134	12
					13
					14
					15
					16
					17
A8C1	36D373G040DD2B	CAPACITOR 37,000/40V	56289	6-10709	18
A8C2	36D373G040DD2B	CAPACITOR 37,000/40V	56289	6-10709	19
A8C3	36D373G040DD2B	CAPACITOR 37,000/40V	56289	6-10709	20
A8C4	36D373G040DD2B	CAPACITOR 37,000/40V	56289	6-10709	21
A8C5	36D373G040DD2B	CAPACITOR 37,000/40V	56289	6-10709	22
A8C6	36D373G040DD2B	CAPACITOR 37,000/40V	56289	6-10709	23
A8C7	36D373G040DD2B	CAPACITOR 37,000/40V	56289	6-10709	24
A8C8	36D373G040DD2B	CAPACITOR 37,000/40V	56289	6-10709	25
					26
					27
					28
	CMC 48	CLAMP, CAPACITOR	56289	2-41052	29
	8469	SPACER 10-32 x 1 1/2 Lg.	83330	2-10174	30
					31
					32
					33
					34
					35
					36

MODEL 1001T and 1201T | CALICO P/N 4100-401 | ASSY R.O. A8

TITLE FILTER ASSEMBLY | SHT 3 OF 4

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	6-32 x 1/4 HEX	NUT, HEX			37
	10-32	NUT, HEX			38
					39
					40
					41
	#6	WASHER, FLAT			42
	#10	WASHER, FLAT			43
					44
					45
					46
	#6	WASHER, INT. LOCK			47
	#10	WASHER, INT. LOCK			48
	#10 - MED WT	WASHER, SPLIT LOCK			49
					50
					51
	10-32 x 1/2 Lg.	SCREW, PAN HEAD			52
	10-32 x 1 1/4 Lg.	SCREW, PAN HEAD		2-10175	53
					54
					55
	10-32 x 5/8 LG.	HEX HEAD MACHINE SCREW		2-10461	56
	10-32 x 7/8 LG.	HEX HEAD MACHINE SCREW		2-10462	57

MODEL 1001T and 1201T | CALICO P/N 4100-401 A | ASSY R.O. A8

TITLE FILTER ASSEMBLY | SHT 4 OF 4

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A7	4150-401-1	HEATSINK ASSY.	16067		1
					2
					3
A7CR1	70H20A	DIODE	07716	3-10218	4
A7CR2	70H20A	DIODE	07716	3-10218	5
A7CR3	70HR20A	DIODE	07716	3-10217	6
A7CR4	70HR20A	DIODE	07716	3-10217	7
					8
					9
					10
	D4100-206-8	INSULATOR	16067	2-10043	11
	D4100-206-9	INSULATOR	16067	2-10044	12
	C4100-209-7	HEATSINK	16067	2-10040	13
	AWG12	WIRE INSULATED, RED			14
	AWG12	WIRE INSULATED, BRN			15
	AWG12	WIRE INSULATED, ORN			16
	AWG12	WIRE INSULATED, YEL			17
	THERMATE	SILICONE COMPOUND			18
					19
					20
	RD 9361	RING LUG, INSULATED	59730		21
	D8-10	RING LUG	00779	2-50103	22
					23
					24
					25
	6-32 x 1/2 LG.	SCREW, HEX HEAD		2-10460	26
	6-32 x 1/2 LG.	SCREW, PAN HEAD			27
	10-32 x 5/8 LG.	SCREW, PAN HEAD			28
					29
	#6	WASHER, SPLIT LOCK			30
	#6	WASHER, EXT. LOCK			31
	#10	WASHER, EXT. LOCK			32
					33
					34
	#6-32 x 5/16	NUT, HEX			35
					36

MODEL	CALICO P/N		ASSY R.D.
1501T	4150-401	B	
TITLE		SHT OF	
HEATSINK ASSY., RECTIFIER DIODE		3 3	A7

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	D4100-210-7	HEATSINK	16067	2-10023	37
	D4100-701-1	P.C. BOARD ASSY	16067	1-60089	38
					39
	6-32 x 3/8 Lg.	SCREW, PAN HEAD			40
	4-40 x 5/16 Lg.	SCREW, PAN HEAD			41
	4-40 x 5/8 Lg.	SCREW, PAN HEAD			42
					43
					44
					45
	6-32 x 1/4 HEX	NUT, HEX			46
					47
					48
					49
	#6	WASHER, INT. LOCK			50
	#4	WASHER, INT. LOCK			51
					52
	#6	WASHER, FLAT			53
					54
					55
					56
	AWG 10	WIRE, WHITE			57
	AWG 14	WIRE, BUSS			58
	AWG 18	WIRE, YELLOW			59
	AWG 18	WIRE, ORANGE			60
	AWG 18	WIRE, GREEN			61
					62
	B-500+	WIRE MARKER	53209		63
					64
	THERMATE	SILICONE COMPOUND			65
					66
	836	CABLE CLAMP	83330		67
					68
	R4142	RING LUG 6/22-18	14726		69
	R4170	RING LUG 10/10	14726		70
					71
					72

MODEL 1001T/1201T/1501T

CALICO P'N 4100-403 D

ASSY R.O. A2

TITLE HEATSINK ASSY, DRIVER

SHT 4 OF 5

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	A2 VALUES LISTED BELOW ARE USED IN				73
	4100-403-2 ASSY. FOR MODEL 1501T ONLY				74
					75
					76
A2Q1	2N4914	TRANSISTOR	04713	3-30175	77
A2Q2	2N6258	TRANSISTOR	95303	3-30226	78
A2Q3	2N6258	TRANSISTOR	95303	3-30226	79
A2Q4	2N6258	TRANSISTOR	95303	3-30226	80
A2Q5	2N6258	TRANSISTOR	95303	3-30226	81
A2Q6	2N6258	TRANSISTOR	95303	3-30226	82
A2Q7	2N6258	TRANSISTOR	95303	3-30226	83
A2Q8	2N6258	TRANSISTOR	95303	3-30226	84
A2Q9	2N6258	TRANSISTOR	95303	3-30226	85
A2Q10	2N6258	TRANSISTOR	95303	3-30226	86
					87
					88
					89
					90
A2R1	RC20GF470J	RESISTOR 47Ω 5% 1/2W	81349	5-20013	91
A2R2	RS-2B-3Ω 5% 3W	RESISTOR 3Ω 5% 3W	91637	5-50182	92
A2R3	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	93
A2R4	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	94
A2R5	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	95
A2R6	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	96
A2R7	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	97
A2R8	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	98
A2R9	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	99
A2R10	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	100
					101
					102
					103
					104
					105
					106
					107
					108

MODEL	CALICO P/N		ASSY R.D.
1501T	4100-403	C	
TITLE		SHT OF	
HEATSINK ASSY. DRIVER		5 5	A2

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	R4142	RING LUG 6/22-18	14726		37
	R4170	RING LUG 10/10	14726		38
	NY04-040	NYLON BUSHING	08289	2-10076	39
	D4100-210-7	HEATSINK	16067	2-10023	40
	D4100-701-1	P. C. BOARD ASSY	16067	1-60089	41
					42
	THERMATE	COMPOUND, SILICONE			43
	DM-123	WASHER, MICA	08289	3-30192	44
	836	CABLE CLAMP	83330		45
					46
					47
	6-32 x 3/8 Lg.	SCREW, PAN HEAD			48
	4-40 x 5/16 Lg.	SCREW, PAN HEAD			49
	4-40 x 5/8 Lg.	SCREW, PAN HEAD			50
					51
					52
					53
	6-32 x 1/4 HEX	NUT, HEX			54
					55
					56
	#6	WASHER, INT. LOCK			57
	#4	WASHER, INT. LOCK			58
					59
					60
	#6	WASHER, FLAT			61
					62
					63
	AWG 18	WIRE, BLUE			64
	AWG 10	WIRE, WHITE			65
	AWG 14	WIRE, BUSS			66
	AWG 14	SLEEVING, TEFLON			67
	AWG 18	WIRE, BLACK			68
	AWG 18	WIRE, RED			69
	B-500 +	WIRE MARKER	53209		70
					71
					72

MODEL 1001T/1201T/1501T	CALICO P/N 4100-404	D		ASSY R.O.
TITLE HEATSINK ASSY, DRIVER		SHT 4 OF 5		A4

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	A4 VALUES LISTED BELOW ARE USED IN				73
	4100-404-2 ASSY. FOR MODEL 1501T ONLY				74
					75
					76
					77
A4C1	WMF 1D1	CAPACITOR 100PF	14655	6-10060	78
					79
					80
A4Q1	2N4905	TRANSISTOR	04713	3-30157	81
A4Q2	2N6258	TRANSISTOR	95303	3-30226	82
A4Q3	2N6258	TRANSISTOR	95303	3-30226	83
A4Q4	2N6258	TRANSISTOR	95303	3-30226	84
A4Q5	2N6258	TRANSISTOR	95303	3-30226	85
A4Q6	2N6258	TRANSISTOR	95303	3-30226	86
A4Q7	2N6258	TRANSISTOR	95303	3-30226	87
A4Q8	2N6258	TRANSISTOR	95303	3-30226	88
A4Q9	2N6258	TRANSISTOR	95303	3-30226	89
A4Q10	2N6258	TRANSISTOR	95303	3-30226	90
					91
					92
					93
A4R1	RC20GF470J	RESISTOR 47Ω 5% 1/2W	81349	5-20013	94
A4R2	RS-2B-3Ω 5% 3W	RESISTOR 3Ω 5% 3W	91637	5-50182	95
A4R3	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	96
A4R4	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	97
A4R5	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	98
A4R6	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	99
A4R7	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	100
A4R8	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	101
A4R9	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	102
A4R10	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	103
A4R11	BWH 1Ω 5% 2W	RESISTOR 1Ω 5% 2W	07716	5-40001	104
					105
					106
					107
					108

MODEL	1501T	CALICO P/N	4100-404	C	ASSY R.D.
TITLE	HEATSINK DRIVER		SHT 5 OF 5		A4

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	D4100-210-7	HEATSINK	16067	2-10023	73
	D4100-701-1	P.C. BOARD ASSEMBLY	16067	1-60089	74
	#6	WASHER, INT. LOCK			75
	#4	WASHER, INT. LOCK			76
					77
					78
					79
	#6	WASHER, FLAT			80
					81
					82
					83
	AWG 18	WIRE, BUSS			84
	AWG 18	WIRE, GREEN			85
	AWG 18	WIRE, RED			86
	AWG 14	WIRE, BUSS			87
	AWG 10	WIRE, WHITE			88
					89
	6-32 x 3/8 LG.	SCREW, PAN HEAD			90
	4-40 x 5/16 LG.	SCREW, PAN HEAD			91
	4-40 x 5/8 LG.	SCREW, PAN HEAD			92
	6-32 x 1/4 HEX	NUT			93
					94
					95
	836	CABLE CLAMP	83330		96
	THERMATE	SILICON COMPOUND			97
	B-500 +	WIRE MARKER	53209		98
					99
	R4142	RING LUG 6/22-18	14726		100
	R4170	RING LUG 10/10	14726		101
					102
					103
					104
					105
					106
					107
					108

MODEL	CALICO P/N		ASSY R.O.
1001T/1201T/1501T	4100-405	D	A3/ A5

TITLE	SHT	OF
HEATSINK, POWER	5	6

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	A3 VALUES LISTED BELOW ARE USED IN				109
	4100-405-3 ASSY. FOR MODEL 1501T ONLY				110
	(A5 ASSY FOR 1501T IS IDENTICAL TO A3 BELOW).				111
					112
					113
A3Q1	2N6258	TRANSISTOR	95303	3-30226	114
A3Q2	2N6258	TRANSISTOR	95303	3-30226	115
A3Q3	2N6258	TRANSISTOR	95303	3-30226	116
A3Q4	2N6258	TRANSISTOR	95303	3-30226	117
A3Q5	2N6258	TRANSISTOR	95303	3-30226	118
A3Q6	2N6258	TRANSISTOR	95303	3-30226	119
A3Q7	2N6258	TRANSISTOR	95303	3-30226	120
A3Q8	2N6258	TRANSISTOR	95303	3-30226	121
A3Q9	2N6258	TRANSISTOR	95303	3-30226	122
A3Q10	2N6258	TRANSISTOR	95303	3-30226	123
					124
					125
					126
A3R1	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	127
A3R2	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	128
A3R3	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	129
A3R4	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	130
A3R5	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	131
A3R6	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	132
A3R7	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	133
A3R8	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	134
A3R9	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	135
A3R10	RS-7-0R1-5%	RESISTOR .1Ω 5% 7W	91637	5-50104	136
					137
					138
					139
					140
					141
					142
					143
					144

MODEL 1501T | CALICO P/N 4100-405 C | ASSY R.D. A3/A5

TITLE HEATSINK ASSEMBLY--POWER | SHT 6 OF 6

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1	4100-700-1	P. C. BOARD ASSY.	16067	(1001T/1201T)	1
	-7	P. C. BOARD	16067	1-60091	2
		EYELET (See Sheet 3)			3
A1	4100-700-2	P. C. BOARD ASSY.	16067	(Model 1501T)	4
					5
	("A" Suffix Ref. Des. are For 1001T/1201T and "B" suffix are for 1501T				6
A1C1	1DP-3-224	CAPACITOR .22/100V	04062	6-10566	7
A1C2	TE-1127	CAPACITOR 5/12V	56289	6-10708	8
A1C3	ZA1A274K	CAPACITOR .27/100V 10%	27556	6-10846	9
A1C4	TE-1090	CAPACITOR 20/6V	56289	6-10444	10
A1C5	TE-1090	CAPACITOR 20/6V	56289	6-10444	11
A1C6	WMF1D15	CAPACITOR .0015μF	14655	6-10068	12
A1C7	BR250-50	CAPACITOR 250/50V	14655	6-10395	13
A1C8	BR250-15	CAPACITOR 250/15V	14655	6-10391	14
A1C9	DM15-501J	CAPACITOR 500PF	14655	6-10649	15
A1C10	TVA-1315	CAPACITOR 500/50V	56289	6-10187	16
A1C11	TE-1303	CAPACITOR 5/50V	56289	6-10331	17
A1C12	WMF1D1	CAPACITOR 1000PF	14655	6-10060	18
A1C13	1DP-2-104	CAPACITOR .10/100V	04062	6-10131	19
A1C14	1DP-2-104	CAPACITOR .10/100V	04062	6-10131	20
A1C15A		CAPACITOR Option F			21
A1C15B	CM05ED390J03	CAPACITOR 39pF 500V	81349	6-10013	22
A1CR1	1N5240B	DIODE	04713	3-10169	23
A1CR2	1N5226B	DIODE	04713	3-10129	24
A1CR3	1N914	DIODE	04713	3-10118	25
A1CR4	1N5240B	DIODE	04713	3-10169	26
A1CR5	1N914	DIODE	04713	3-10118	27
A1CR6	1N914	DIODE	04713	3-10118	28
A1CR7	1N4001	DIODE	04713	3-10151	29
A1CR8	1N4001	DIODE	04713	3-10151	30
A1CR9	1N4001	DIODE	04713	3-10151	31
A1CR10	1N4001	DIODE	04713	3-10151	32
A1CR11	1N4001	DIODE	04713	3-10151	33
A1CR12	NOT USED				34
A1CR13	1N4001	DIODE	04713	3-10151	35
A1CR14	1N4001	DIODE	04713	3-10151	36

MODEL 1001T/1201T/1501T | CALICO P/N 4100-700 | E | ASSY R.D.

TITLE P. C. BOARD ASSY. PREAMPLIFIER | SHT 4 OF 7 | A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
					37
					38
A1Q1	CIC 350	TRANSISTOR	16067	3-30016	39
A1Q2	CIC 333	TRANSISTOR	16067	3-30012	40
A1Q3	CIC 330	TRANSISTOR	16067	3-30008	41
A1Q4	CIC 718	TRANSISTOR	16067	3-30041	42
A1Q5	CIC 718	TRANSISTOR	16067	3-30041	43
A1Q6	CIC 718	TRANSISTOR	16067	3-30041	44
A1Q7	2N3741	TRANSISTOR	04713	3-30102	45
A1Q8	40529	TRANSISTOR	95303	3-30195	46
A1Q9	2N3767	TRANSISTOR	04713	3-30103	47
A1Q10	2N2102	TRANSISTOR	81349	3-30075	48
A1Q11	2N4036	TRANSISTOR	81349	3-30106	49
A1Q12	2N2102	TRANSISTOR	81349	3-30075	50
					51
					52
A1R1	RN60D6810F	RESISTOR 681Ω 1/4W 1%	81349	5-60017	53
A1R2	TBD	RESISTOR	81349		54
A1R3	RN60C4991F	RESISTOR 4.99K 1/8W 1%	81349	5-60238	55
A1R4	RN60C1473F	RESISTOR 147K 1/8W 1%	81349	5-60340	56
A1R5	RN60C2002F	RESISTOR 20K 1/8W 1%	81349	5-60239	57
A1R6	NOT USED				58
A1R7	RN60C1003F	RESISTOR 100K 1/8W 1%	81349	5-60131	59
A1R8	RC07GF513J	RESISTOR 51K 1/4W 5%	81349	5-10093	60
A1R9	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	61
A1R10	RN60C4992F	RESISTOR 49.9K 1/8 1%	81349	5-60114	62
A1R11	2387-203	POTENTIOMETER 20K	91637	5-70084	63
A1R12	RN60C4992F	RESISTOR 49.9K 1/8W 1%	81349	5-60114	64
A1R13	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	65
A1R14	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	66
A1R15	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	67
A1R16	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	68
A1R17	RC07GF122J	RESISTOR 1.2K 1/4W 5%	81349	5-10055	69
A1R18	RC07GF242J	RESISTOR 2.4K 1/4W 5%	81349	5-10061	70
A1R19A	RC07GF471J	RESISTOR 470Ω 1/4W 5%	81349	5-10045	71
A1R19B	RC07GF201J	RESISTOR 200Ω 1/4W 5%	81349	5-10036	72

MODEL 1001T/1201T/1501T | CALICO P/N 4100-700 | E | ASSY R.D.

TITLE P. C. BOARD ASSY, PREAMPLIFIER | SHT 5 OF 7 | A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R20A	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10068	73
A1R20B	RC07GF222J	RESISTOR 2.2K 1/4W 5%	81349	5-10060	74
A1R21A	RC07GF471J	RESISTOR 470Ω 1/4W 5%	81349	5-10045	75
A1R21B	RC07GF201J	RESISTOR 200Ω 1/4W 5%	81349	5-10036	76
A1R22	RC07GF821J	RESISTOR 820Ω 1/4W 5%	81349	5-10051	77
A1R23	4411	RESISTOR 500Ω 3-1/4W	44655	5-50157	78
					79
A1R24	RC07GF131J	RESISTOR 130Ω 1/4W 5%	81349	5-10032	80
A1R25	NOT USED				81
A1R26	RC07GF821J	RESISTOR 820Ω 1/4W 5%	81349	5-10051	82
A1R27	RC07GF511J	RESISTOR 510Ω 1/4W 5%	81349	5-10046	83
A1R28	RC07GF511J	RESISTOR 510Ω 1/4W 5%	81349	5-10046	84
A1R29	RC07GF912J	RESISTOR 9.1K 1/4W 5%	81349	5-10075	85
A1R30	4411	RESISTOR 500Ω 3-1/4W	44655	5-50157	86
A1R31	RC07GF392J	RESISTOR 3.9K 1/4W 5%	81349	5-10066	87
A1R32	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10053	88
A1R33	RN60D1002F	RESISTOR 10K 1/4W 1%	81349	5-60079	89
A1R34	RN60D1002F	RESISTOR 10K 1/4W 1%	81349	5-60079	90
A1R35	RC07GF390J	RESISTOR 39Ω 1/4W 5%	81349	5-10019	91
A1R36	RC20GF100J	RESISTOR 10Ω 1/2W 5%	81349	5-20006	92
A1R37	RC20GF220J	RESISTOR 22Ω 1/2W 5%	81349	5-20008	93
A1R38	RC20GF390J	RESISTOR 39Ω 1/2W 5%	81349	5-20012	94
A1R39	RC20GF320J	RESISTOR 33Ω 1/2W 5%	81349	5-20011	95
A1R40	RC07GF470J	RESISTOR 47Ω 1/4W 5%	81349	5-10021	96
A1R41	RC07GF123J	RESISTOR 12K 1/4W 5%	81349	5-10078	97
A1R42	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10053	98
A1R43	RC07GF470J	RESISTOR 47Ω 1/4W 5%	81349	5-10021	99
A1R44	RC07GF180J	RESISTOR 18Ω 1/4W 5%	81349	5-10011	100
A1R45	RC07GF822J	RESISTOR 8.2K 1/4W 5%	81349	5-10074	101
A1R46	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	102
A1R47	RC07GF180J	RESISTOR 18Ω 1/4W 5%	81349	5-10011	103
A1R48	RC07GF123J	RESISTOR 12K 1/4W 5%	81349	5-10078	104
A1R49	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	105
A1R50	RC07GF180J	RESISTOR 18Ω 1/4W 5%	81349	5-10011	106
A1R51	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	107
A1R52	RC07GF123J	RESISTOR 12K 1/4W 5%	81349	5-10078	108

MODEL 1001T/1201T/1501T | CALICO P/N 4100-700 | E | ASSY R.D.

TITLE P. C. BOARD ASSY. PREAMPLIFIER | SHT 6 OF 7 | A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF DES	MFG NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R53	U201R101B	POTENTIOMETER, 100Ω	71450	5-70107	109
A1R54	U201R101B	POTENTIOMETER 100Ω	71450	5-70107	110
A1R55	RC07GF180J	RESISTOR 18Ω 1/4W 5%	81349	5-10011	111
A1R56	RC07GF180J	RESISTOR 18Ω 1/4W 5%	81349	5-10011	112
A1R57	U201R101B	POTENTIOMETER 100Ω	71450	5-70107	113
A1R58		RESISTOR TBD			114
A1R59	RC32GF470J	RESISTOR 47Ω 1W 5%	81349	5-30068	115
A1R60	RC32GF470J	RESISTOR 47Ω 1W 5%	81349	5-30068	116
					117
					118
A1T1	T-31X	TRANSFORMER	81095	7-10130	119
					120
	MF20T	HEATSINK	13103	2-41050	121
	LB66B1B	HEATSINK	98978	2-41047	122
	RCT05075-7A	TRANSIPAD	19080	2-40296	123
	RCTO18110-1A	TRANSIPAD	19080	2-40297	124
					125
					126
	AWG22	WIRE, BUSS			127
	AWG22	SLEEVING, TEFLON			128
					129
					130
	4-40 x 1/4 LG.	SCREW, PAN HD.			131
	6-32 x 3/8 LG.	SCREW, PAN HD.			132
					133
					134
					135
	#6	WASHER, INT. LOCK			136
					137
					138
	4-40 UNC - 3/16	NUT, 3/16 HEX			139
	6-32 x 1/4 HEX	NUT, HEX			140
					141
					142
					143
					144

MODEL 1001T/1201T/1501T | CALICO P/N 4100-700 E | ASSY R.D.

TITLE P. C. BOARD ASSY, PREAMPLIFIER | SHT 7 OF 7 | A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	D4120-700-1	P. C. BOARD ASSY	16067		1
	-7	P. C. BOARD MECH	16067	1-60132	2
		EYELET SEE SHEET 3			3
					4
THE FOLLOWING ROLL VALUES ARE FOR THE MODEL 1201T/ and 1501T					5
					6
C1	ZA2C474	CAPACITOR .47μF 200V	27556	6-10235	7
C2	4DP-3-104	CAPACITOR .1μF 400V	72136	6-10823	8
C3	6DP-1-273	CAPACITOR .027μF 600V	72136	6-10107	9
C4	6DP-1-682	CAPACITOR .0068μF 600V	72136	6-10824	10
					11
					12
					13
R1	BWH 2.7Ω 5% 2W	RESISTOR 2.7Ω 2W 5%	07716	5-40051	14
R2	RC42GF120J	RESISTOR 12Ω 2W 5%	81349	5-40052	15
R3	RC42GF470J	RESISTOR 47Ω 2W 5%	81349	5-40044	16
R4	RC42GF181J	RESISTOR 180Ω 2W 5%	81349	5-40020	17
					18
					19
					20
	16 AWG	BUSS WIRE			21
	16 AWG	TEFLON SLEEVING			22
					23
					24
					25
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MODEL	1201T/1501T	CALICO P/N	4120-700	C	ASSY R.D.
TITLE	SELECTOR CARD ASSY	SHT	4 OF 5		A9

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6	4050-702-1	VOLTMETER BD. ASSY	16067		1
	-7	P.C. BOARD	16067	1-57003	2
		EYELET (SEE SHEET 3)			3
A6	4050-702-2	VOLTMETER BD. ASSY	16067		4
					5
					6
A6CR1	1N914	DIODE	JEDEC	3-10118	7
A6CR2	1N914	DIODE	JEDEC	3-10118	8
A6CR3	1N914	DIODE	JEDEC	3-10118	9
A6CR4	1N914	DIODE	JEDEC	3-10118	10
					11
					12
A6R1B	ET34X502	POTENTIOMETER 5K	30983	5-70132	13
A6R1A	CIC U-502	POTENTIOMETER 5K	71450	5-75036	14
A6R2	RC07GF102J	RESISTOR 1K 1/4W 5%	JEDEC	5-10053	15
A6R3	RC07GF682J	RESISTOR 6.8K 1/4W 5%	JEDEC	5-10072	16
A6R4	RC07GF272J	RESISTOR 2.7K 1/4W 5%	JEDEC	5-10062	17
A6R5	RC07GF911J	RESISTOR 910Ω 1/4W 5%	JEDEC	5-10052	18
A6R6	RN60C3322F	RESISTOR 33.2K 1/8W 1%	JEDEC	5-60249	19
A6R7	RN70C2673F	RESISTOR 267K 1/2W 1%	JEDEC	5-60330	20
A6R8	RN60C1333F	RESISTOR 133K 1/8W 1%	JEDEC	5-60329	21
A6R9	RN60C6652F	RESISTOR 66.5K 1/8W 1%	JEDEC	5-60399	22
					23
					24
					25
					26
					27
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					36

MODEL	CALICO P/N	ASSY R.D.
501T	4050-702	A6

TITLE	SHT	OF
VOLTMETER P.C. BOARD ASSEMBLY	4	4

ENDIX A

ng code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbook H4-1 and its latest supplement. Alphabetical codes have been assigned to suppliers not appearing in the H4 Handbook.

ElectriCord	Westfield, Pa.
Tech. Prod. Sales	Sorrento Valley, Ca.
Jackson Bros.	Waddon, Surrey, England
Chicago Std. Transformer Co.	Chicago, Ill.
Use Code #08289	
Colvern	Santa Monica, Ca.
Use Code #30983	
Mial Of Italy c/o Q. C. Components	Los Angeles, Ca.
Monsanto, Electronic Special Products	Cupertino, Ca.
Silicon General	Los Angeles, Ca.
Elma	Schweiz, Germany
Intersil	Cupertino, Ca.
Precision Dynamics Corp.	Burbank, Ca.
Ansley	Los Angeles, Ca.
American Handle	Philadelphia, Pa.
OPCDA	Edison, N.J.
Elpower	Santa Ana, Ca.
Use Code #0000L	
Falmat	Los Angeles, Ca.
Pic Design Corp.	E. Rockaway, N.Y.
Metal-Cal Div., Avery Prod. Corp.	Inglewood, Ca.
Aerovox Corporation	New Bedford, Mass.
AMP, Inc.	Harrisburg, Pa.
Sangamo Electric Company	Pickens, S.C.
Gee Eng. Co., Inc.	City of Industry, Ca.
Allen-Bradley Company	Milwaukee, Wis.
Litton Industries, Inc.	Beverly Hills, Ca.
T R W Semiconductors, Inc.	Lawndale, Ca.
Texas Instruments, Inc.	Dallas, Tex.
Spectrol Electronics	City of Industry, Ca.
Ferroxcube Corp.	Saugerties, N.Y.
Fairchild Controls Corp.	Hicksville, Ll. N.Y.
Amphenol Corporation	Broadview, Ill.
Use Code #72136	
General Electric Company	Syracuse, N.Y.
General Electric Company	Syracuse, N.Y.
General Electric Company	Somersworth, N.H.
Eldema Corporation	Compton, Ca.
Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.
Clairex Corporation	New York, N.Y.
Arrow-Hart and Hegeman Elec. Co.	Hartford, Ct.
Use Code #72136	
Motorola Semiconductor Prod., Inc.	Phoenix, Ariz.
3-M	St. Paul, Minn.
Jonathan Mfg. Co.	Fullerton, Ca.
Pomona Electronics Co , Inc.	Pomona, Ca.
Ultronix	Grand Junction, Colo.
Kemet, Union Carbide Corp.	Cleveland, Ohio
Wakefield Engineering, Inc.	Wakefield, Mass.
Conelco Components	San Bernadino, Ca.
Kooltronic Fan Company	Princeton, N.J.
Electrovert, Incorporated	Mt. Vernon, N.Y.
Stantron, Wyco Metal Products	N. Hollywood, Ca.
Amathom Elect. Hardward	New Rochelle, N.Y.
Magnetic Shield Div.	Chicago, Ill.
Robinson, Nugent, Inc.	New Albany, Ind.
Richco Plastics, Co.	Chicago, Ill.
Kelvin Electric Company	Van Nuys, Ca.
Silicon Transistor Corp.	Garden City, N.Y.
Fairchild Camera and Instr. Corp.	Mt. View, Ca.
Birtcher Corporation	Los Angeles, Ca.
Unitrack Calabro Plastics	Upper Darby, Pa.
Sperry Rand Corporation	Norwalk, Conn.
I R C, Incorporated	Burrington, Iowa
Continental Devices	Hawthorne, Ca.
Accurate Rubber and Plastics Co.	San Diego, Ca.
Spectra Strip	Garden Grove, Ca.
Blinn-Delbert Co., Inc.	Pomona, Ca.
Use Code #71468	
Vemaline Products Co.	Franklin Lakes, N.J.
Babcock Electronics Corp.	Costa Mesa, Ca.
Atohm, Technical Industries, Inc.	Burbank, Ca.
C and K Components, Inc.	Newton, Mass.
Diamond Metal Sales	Gardena, Ca.
Cherry Rivet Div., Townsend Co.	Santa Ana, Ca.
Ovenaire, Incorporated	Charlottesville, Va.
Bendix Corporation	Santa Ana, Ca.
Hysol Corporation	El Monte, Ca.
Elpac, Incorporated	Fullerton, Ca.
Omitronics Mfg., Incorporated	Omaha, Neb.
Clarostat Mfg. Co., Incorporated	Dover, N.H.
Thermalloy Company	Dallas, Tex.
Texas Crystals	River Grove, Ill.
Electronic Research	Overland Park, Kans.
Burr-Brown Research Corp.	Tucson, Ariz.
Semtech Corporation	Newbury Park, Ca.
Cornell-Dubilier Elect. Corp.	Newark, N.J.
Hollingsworth Co.	Phoenixville, Pa.
Electro Cube, Incorporated	San Gabriel, Ca.
Electra Scientific Corporation	Fullerton, Ca.
Elec-trol	Northridge, Ca.
Fenwall Electronics	Framingham, Mass.
Amelco, Teledyne, Incorporated	Mt. View, Ca.
Use Code #17870	
Digital Sensors, Incorporated	Los Angeles, Ca.
California Instruments Company	San Diego, Ca.
Delco Radio Div., General Motors	Kokomo, Ind.
Simpson Instruments, Inc.	Escondido, Ca.
Angetrohm Precision, Inc.	Van Nuys, Ca.
Mektron, California General, Inc.	Chula Vista, Ca.
Daven Div., Thomas A. Edison	Manchester, N.H.
Umpco	City of Industry, Ca.
Wilshire Foam Products, Inc.	Gardena, Ca.
Vactec Inc.	Maryland Heights, Mo.
Signatics	Sunnyvale, Ca.
Vishay Instruments Inc.	Malvern, Pa.
Scambe Mfg. Co.	Monterey Park, Ca.
Ducommun Metals and Supply Co.	Los Angeles, Ca.
R C A	Mountaintop, Pa.
The Robinson Company	Hawthorne, Ca.
Potter Company	Sun Valley, Ca.
South Bay Cable Corp.	Gardena, Ca.
Behr-Manning	Watervliet, N.Y.
Buckeye Stamping Company	Columbus, Ohio
Jordan Elect	Van Nuys, Ca.
Elastic Stop Nut Corporation	Van Nuys, Ca.
Deccofelt Products Company	Glendora, Ca.
Product Components Corp.	Hastings-on-Hudson, N.Y.
British Radio Electric Ltd.	Washington, D.C.
Pamotor, Incorporated	San Francisco, Ca.
E C C	Burlington, Mass.
Parelco Inc.	Paramount, Ca.
Specialty Connector Co., Inc.	Indianapolis, Inc.
Amperex (Diodes)	Slaterville, R.I.
Victoreen Instrument Co., Inc.	Oak Lawn, Ill.
Dabura Electronics and Cable Corp.	New York, N.Y.
Lamcor, Incesporated	Anaheim, Ca.

26533	Zero Manufacturing Company	Burbank, Ca.
27014	National Semi-Conductor Corp.	Santa Clara, Ca.
27191	Cutler-Hammer, Inc.	Milwaukee, Wisc.
27264	Molex	Downers Grove, Ill
27556	IMB Electronic Products	Santa Fe Springs, Ca.
27683	Varo, Incorporated	St. Garland, Tex.
28480	Hewlett-Packard Co.	Palo Alto, Ca.
28520	Heyman Mfg. Company (Heyco)	Kenilworth, N.J.
30086	I-T-E Circuit Breaker Co.	Philadelphia, Pa.
30817	Instrument Specialties Co.	Little Falls, N.J.
30983	Electra/Midland	San Diego, Ca.
31951	Tririge Inc.	Pittsbury, Pa.
35929	Constanta	Quebec, Canada
42190	Muter Company	Chicago, Ill.
44655	Ohmite Manufacturing Company	Skokie, Ill.
45722	Parker-Kalon	Clifton, N.J.
46384	Penn. Eng. and Mfg. Corp.	Doylestown, Pa.
49956	Raytheon Co.	Lexington, Ma.
53209	W. H. Brady Co.	Milwaukee, Wis.
56289	Sprague Electric Company	North Adams, Mass.
58474	Superior Electric Company	Bristol, Ct.
59730	Thomas and Betts Company	Elizabeth, N.J.
60741	Triplett Electrical Instrument Co.	Bluffton, Ohio
63743	Ward Leonard Electric Co.	Mt. Vernon, N.Y.
70903	Belden Manufacturing Co.	Chicago, Ill.
71002	Birnbach Radio Company, Inc.	New York, N.Y.
71279	Cambridge Thermionic Corp.	Cambridge, Mass.
71400	Buesman Mfg. Div., McGraw-Edison Co.	St. Louis, Mo.
71450	CTS Corporation	Elkhart, Ind.
71468	ITT Cannon Electric, Inc.	Los Angeles, Ca.
71590	Centralab Div., Globe-Union, Inc.	Milwaukee, Wis.
71744	Chicago Miniature Lampworks	Chicago, Ill.
71785	Cinch Manufacturing Company	Chicago, Ill.
72136	Elmenco (Electro Motive)	Willimantic, Ct.
72259	Nytronics, Incorporated	Berkeley Heights, N.J.
72619	Dialight Corporation	Brooklyn, N.Y.
72699	General Instruments	Newark, N.J.
72982	Erie Technological Products, Inc.	Erie, Pa.
73138	Beckman Instruments, Inc.	Fullerton, Ca.
73445	Amperex (Capacitors)	Long Island, N.Y.
73559	Carling Electric, Inc.	West Hartford, Ct.
73734	Federal Screw Products, Inc.	Chicago, Ill.
73899	J F D Electronics Company	Brooklyn, N.Y.
73949	Guardian Electric Mfg. Co.	Chicago, Ill.
73957	Groov-Pin Corporation	Ridgefield, N.J.
74193	Heinemann Electric Company	Trenton, N.J.
74276	Signalite, Incorporated	Neptune, N.J.
74542	Hoyt Electrical Instrument Works	Penacook, N.H.
74545	Harvey Hubbel, Inc.	Bridgeport, Ct.
74970	E. F. Johnson Company	Waseca, Minn.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75915	Littlefuse, Incorporated	Des Plaines, Ill.
75987	Use Code #95987	
76055	Mallory Controls	Frankfort, Ind.
76348	Miller Products Company	New York, N.Y.
76493	J. W. Miller Company	Los Angeles, Ca.
76854	Oak Manufacturing Company	Crystal Lake, Ill.
77342	Potter and Brumfield Div., Amer. Machine and Foundry Company	E. Princeton, Ind.
78189	Shakeproof Div., Illoms Tool Works	Chicago, Ill.
78299	Struthers-Dunn, Incorporated	Pitman, N.J.
78488	Stackpole Carbon Company	St. Marys, Pa.
78526	Stanwyck Winding Company, Inc.	Newburgh, N.Y.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78947	Ucinite Company	Newtonville, Mass.
79130	Johns-Manville Products Corp.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corporation	New Rochelle, N.Y.
80112	G. C. Electronics Company	Los Angeles, Ca.
80223	United Transformer Co.	New York, N.Y.
80294	Bourns, Incorporated	Riverside, Ca.
80368	Sylvania Electric Products, Inc.	New York, N.Y.
81073	Grayhill, Incorporated	La Grange, Ill.
81095	Triad Transformer Corp.	Venice, Ca.
81312	Winchester Electronics	Oakville, Ct.
81349	Military Spec., Standardization Division, Directorate of Logistic Services DSA	
82104	Standard Grigsby	Aurora, Ill.
82389	Switchcraft, Incorporated	Chicago, Ill.
82877	Rotron Manufacturing Co., Inc.	Woodstock, N.Y.
83058	Car Fastener Company	Cambridge, Mass.
83324	Rosan, Incorporated	Newport Beach, Ca.
83330	Herman H. Smith, Inc.	Brooklyn, N.Y.
83594	Burroughs Corporation	Plainfield, N.J.
83701	Electronic Devices, Incorporated	Yonkers, N.Y.
84171	Arco Electronics, Inc.	Great Neck, N.Y.
86684	R C A	Harrison, N.J.
87034	Marco-Oak Industries	Anaheim, Ca.
88026	Use Code #27191	
88245	Useco Div., Litton Industries	Van Nuys, Ca.
90201	Mallory Capacitor Company	Indianapolis, Ind.
91506	Augat	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Neb.
91662	Elco Corporation	Willow Grove, Pa.
91812	Janco Corporation	Burbank, Ca.
91833	Keystone Electronics Corp.	New York, N.Y.
91929	Micro Switch Div., Honeywell, Inc.	Freeport, Ill.
92194	Alpha Wire Corporation	Elizabeth, N.J.
92219	Waldom Electronics, Inc.	Chicago, Ill.
93332	Sylvania Electric Products, Inc.	Woburn, Mass.
94222	Southco, Incorporated	Lester, Pa.
95146	Alco Electronics Products	Lawrence, Mass.
95303	R C A	Cincinnati, Ohio
95416	Use Code #95146	
95987	Weckeeser Company, Inc.	Chicago, Ill.
96682	Genisco, Incorporated	Compton, Ca.
97525	Electronic Engineering Co.	Santa Ana, Ca.
97954	U.S. Components, Incorporated	Bronx, N.Y.
98159	Rubber Teck, Incorporated	Gardena, Ca.
98278	Microdot, Incorporated (Lerco)	S. Pasadena, Ca.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98978	IERC	Burbank, Ca.
99028	Globe	Gardena, Ca.
99392	STM Corporation	Oakland, Ca.
99515	Marshall Industries	Monrovia, Ca.
99517	Vacco Industries	El Monte, Ca.
99800	Delevan Electronics Corporation	Aurora, N.Y.
99742	Permacel Div , Johnson and Johnson	New Brunswick, N.J.
99743	I M C	Maywood, Ca.

ONE YEAR WARRANTY

CALIFORNIA INSTRUMENTS COMPANY a division of AIKEN INDUSTRIES INC. warrants each instrument manufactured by them to be free from defects in material and workmanship for a period of one year from the date of shipment to the original purchaser. Excepted from this warranty are tubes, fuses, and batteries which carry the warranty of their original manufacturer where applicable. CALIFORNIA INSTRUMENTS COMPANY will service, replace, or adjust any defective part or parts, free of charge, when the instrument is returned to the Company freight prepaid, and when examination reveals that the fault has not occurred because of misuse or abnormal conditions of operation. Equipment repaired beyond the effective date of warranty or when abnormal usage has occurred will be charged at applicable rates. CALIFORNIA INSTRUMENTS COMPANY will submit an estimate for such charges before commencing repair if so requested.

PROCEDURE FOR SERVICE

If a fault develops, notify CALIFORNIA INSTRUMENTS COMPANY or its local representative, giving full details of the difficulty, and including the model number and serial number. On receipt of this information, service data or shipping instructions will be furnished. If shipment is indicated, forward the instrument, freight prepaid, to the authorized repair station indicated in the instruction. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the warranty.

DAMAGE IN TRANSIT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. CALIFORNIA INSTRUMENTS COMPANY will advise the disposition to be made of the equipment and arrange for repair or replacement. Please include model number and serial number when referring to the instrument.

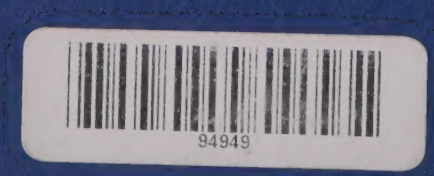
CALICO | CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA | CODE IDENT 16067 | PARTS LIST

ES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	4100-707-1	PRE-AMP BD ASSY-OPTION "H"	16067		1
		100ITH/120ITH/			2
					3
	MODIFY STANDARD 4100-700-1 PRE-AMP BOARD				4
	ASSEMBLY AS SHOWN BELOW:				5
	(NOTE: DO NOT MFR 4100-706-2 ASSY)				6
	DELETE FROM STANDARD BOARD ASSEMBLY:				7
1	IDP-3-224	CAPACITOR .22μF 100V	72136	C-10506	8
C2	TE1127	CAPACITOR 5μF 12V	56289	C-10708	9
C3	ZATA274K	CAPACITOR .27μF 100V	27556	C-10846	10
C4	TE1090	CAPACITOR 20μF 6V	56289	C-10444	11
C5	TE1090	CAPACITOR 20μF 6V	56289	C-10444	12
C6	WMMD15	CAPACITOR .0015μF	14655	C-10068	13
C9	DM15-501J	CAPACITOR 500pF	72136	C-10849	14
C12	WMMD1	CAPACITOR .001μF	14655	C-10060	15
					16
R9	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	17
R20	RC07GF472J	RESISTOR 4.7K 1/4W 5%	81349	5-10058	18
					19
	ADD TO STANDARD BOARD ASSEMBLY:				20
					21
C1	IDP-4-474	CAPACITOR .47μF 100V	72136	C-10577	22
C2	TE1090	CAPACITOR 20μF 6V	56289	C-10444	23
C3	NOT USED				24
C4	T350B476M006AS	CAPACITOR 47μF 6V	05397	C-10775	25
C5	T350B476M006AS	CAPACITOR 47μF 6V	05397	C-10775	26
C6	IDP-1-472	CAPACITOR .0047μF 600V	72136	C-10547	27
C9	CM06FD252J03	CAPACITOR 2500pF 500V	81349	C-10728	28
C12	IDP-1-502	CAPACITOR .005μF 100V	72136	C-10079	29
C101	CM05FD201J03	CAPACITOR 200pF 500V	81349	C-10282	30
R2	NOT USED				31
R9	RC07GF223J	RESISTOR 22K 1/4W 5%	81349	5-10084	32
R20	RC07GF152J	RESISTOR 1.5K 1/4W 5%	81349	5-10057	33
R101	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10081	34
R102	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	35
C102	IDP-3-154K	CAPACITOR .15μF 100V	72136	C-10478	36

4100-707-1H	CALICO P/N 4100-707		ASSY R.D.
PRE-AMP BOARD W/OPTION "H"		SHT 3 OF 3	ATP

MP MASTER
MA28333

Oxford
10%


94949